

NEWS IN PERSPECTIVE

ECONOMIC CLIMATE

ECONOMIC CROSS-CURRENTS are apparent, but there seems to be no real cause for alarm. By any standard, the last few years have seen significant progress. On balance, this can be expected to continue. Over the past six years, population has grown by 11 percent and the labor force has increased by about 9.5 percent. But industrial production over the same period went up 14 percent while the total output of goods and services climbed 16 percent. Concurrently, total personal income--in terms of real purchasing power--gained 21 percent.

A SUBSTANTIAL GAIN in economic activity occurred during the first quarter of 1960 compared with the preceding period. There is now little evidence that the economy is operating under forced draft. But, this leads to an apparent slowing in the rate of growth, which has caused some anxiety.

This is not realistic. Looked at in absolute terms, it can be seen that economic activity will stay high and that worrywarts are concerned only because they expected even more new highs to be set. (In steel, for example, it is clear that the mills will enjoy their biggest production year.)

ELECTRIC UTILITIES' CONTRIBUTION to keeping business jumping, according to the government, will include an estimated \$4-billion in new project starts in the second half of '60--more than in any year since 1957.

MANAGEMENT VIEW

A NEW INDUSTRY IMAGE should be found and projected by electric utilities, advises EEI's Pres. King. Such an image for the utility industry as a whole--comparable to "our local corporate images"--is needed to help sell people

who still are not convinced that 1929 is old history, Mr. King told the recent annual executive conference of the Southeastern Electric Exchange. (See p. 7)

A WINNING RECORD has long been established by private ownership in the electric power field, as re-confirmed by the Central Surveys, Inc. Again in 1959, as in the 14 years past, people voting directly on the issue of company vs. government ownership gave a 2-1 edge to private enterprise--victor in 11 of the 16 elections held last year.

IMPORTANCE OF THE OWNERS of electric companies is getting new stress. Examples: Interstate Power Co., in advertising, is forcefully telling the story of its 21,500 owners--"in all walks of life, in all 50 states" and officials of Wisconsin P. & L. Co. have just made the rounds of 14 "stockholder committee" meetings, reviewing operations and plans for these elected representatives of the company stockholders.

UNREASONABLE PRICE DROP?--ConEdison's commercial-industrial customers (who use more than half of the N. Y. utility's electric output) now pay an average price of 2.63-cents/kwh, compared with 3.09-cents in 1946. Moreover, ConEd feels that "existing rates produce an undue and unreasonable reduction in price as the customer's use increases," adding (in its annual report) that the P. S. Commission seems to recognize this fact too.

MANAGEMENT RECRUITER SOURCE for new manpower to fill top executive job openings is gaining in use, a new survey shows, with more executives being selected from outside the company. Executive Manpower Corp., N. Y., reports that some 145 firms indicate a need for an average of 2.5 top men to fill important jobs in the next six months, compared with an average of 3.2 in the

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second half of 1959. Respondents to the survey anticipated most difficulty in finding management-engineers.

WASHINGTON INFLUENCE

COMPREHENSIVE HYDRO OPERATION bill has been reported out of committee in the House, with 33 members dissenting. Favoring the bill--sometimes with changes--are FPC, the Budget Bureau, and the Departments of Interior, Army, and Agriculture. The bill would require both federal and non-federal users of power from stored water to pay for their benefits. FPC's general counsel foresees not only "direct financial benefit" for the U. S. but says "providing impetus for more practical cooperation between federal and non-federal power interests" would benefit the economy, especially in the Pacific Northwest. The dissenting minority opinion declares that the bill is "bad" and that it "proposes an unnecessary subsidy to private utilities which are already heavily subsidized."

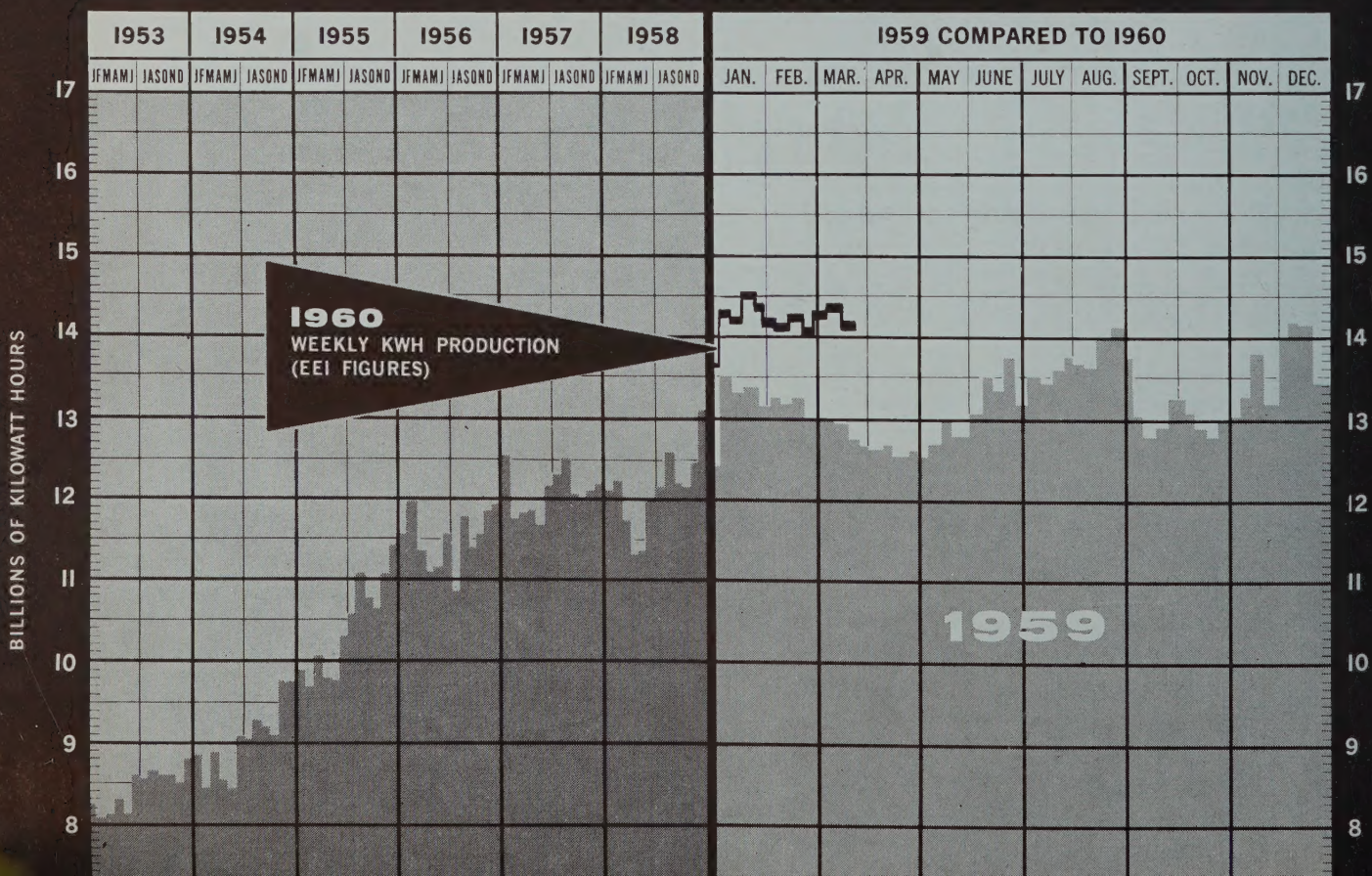
GO-AHEAD ON FRYINGPAN-ARKANSAS is again asked by the Administration. The Interior Department's recommendations to Congress differ from those made in 1953 by substituting Ruedi and possibly Ashcroft for Aspen. The proposed \$170-million multi-purpose project would generate 469-million kwh annually as well as provide recreation facilities on a nonreimbursable basis.

BURNS CREEK HEARINGS brought out clearly in the House--just as they did last session in the Senate--that power is the predominant result of the project. A Reclamation witness testified to the absence of flood control and a Fish and Wildlife witness admitted there were no benefits for his service. Rep. Haley (D., Fla.) declared, "I do not see anything in here, except power" and called the bill "a phony."

MT. SHEEP HEARING POSTPONEMENT produced by the filing of "conflicting" Nez Perce applications by 13 PUD's in the State of Washington, is the result

Electric Utility Barometer

(Source: Edison Electric Institute)



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of "a last available maneuver to which public power die-hards have resorted," charges EL&P's Ralph Elliott. (See page 65.) "By shifting the battle arena from Capitol Hill to FPC, they hope they will find less sensitivity to the welfare of the fish," he surmises.

BRIDGE CANYON CONFLICT--with the City of Los Angeles and the Arizona Power Authority both applying for the same site for hydro development (See EL&P Mar. 15, page 61)--will be ironed out at FPC consolidated hearings in September. The Commission will use its new speed-up system to prevent a protracted hearing.

REAS SOLD 14 PERCENT MORE electric energy in '59 than in '58 according to the agency's annual report. Some 54 percent went to non-farm customers, though 96 percent of U. S. farms are now served. REA customers paid an average of 2.5-cents/kwh, used about 400-kwh a month. REA borrowers' net worth reached a total of \$515-billion (16.6 percent of their total assets). In the year, 250 loans were made, with only two borrowers in arrears more than 30 days. Fiscal 1960?--REA expects loans will be at a level of \$220-million, but only \$110-million in new money is asked from Congress, because of unused balances carried over.

SALE OF SURPLUS BPA POWER, as proposed by PG&E and approved in an Interior Dept. study in Feb., is urged by Interior in a letter to the Senate Interior Committee. Pointed out is the fact that PG&E's offer to buy about \$1.8-million worth of secondary energy annually has already been held up a year by the Committee's request to study a high-voltage intertie between the Pacific Northwest and California. Asserts Asst. Sec'y Aandahl: "It is hard to find a reason for not having made this sale." BPA has been having annual deficits, and this energy waste jeopardizes low rates.

INDUSTRY SIFTINGS

EHV TEST LINE UP TO 750-KV, announced by American Electric Power and Westinghouse, "is the logical extension of the program carried out by these organizations and other manufacturers since

1946." Beginning early in '61, tests will be conducted for 3-5 years at the new site in West Virginia, with Kaiser, Lapp, Ohio Brass, Thomas & Betts and American Bridge cooperating. (See page 69 for story on Ontario Hydro's 460-kv line.)

POWER IN CANADA keeps coming. By year's end B. C. Electric, which completed a third 62,000-kw unit at its Bridge River project last month will be getting a 2-billion kwh annual production from this development. In the east, Ontario Hydro announced a six-year, \$182-million expansion that will be a big start on a 20-year plan for getting 1.5-billion kw from Northeastern Ontario rivers over the next 20 years.

NEW POWER GENERATION METHODS will be adopted by the industry in an "orderly, rather unspectacular" transition, Westinghouse Pres. Cresap predicted at the recent SEE executive conference. And, his company is not overlooking any "sleepers" among the currently known possibilities. This assurance came from Dr. J. A. Hutcheson, Westinghouse v-p for engineering, at the groundbreaking ceremony for the new Westinghouse R&D Center, when he said: "We think it is important to have a broad program . . . to look at all methods that seem feasible . . . (because) no single one of these new methods of energy conversion is likely to be 'the one way to do it.'"

KW's "AT ALMOST NO COST"--This is still the promise of some, like Dr. Boris Pregel, chairman of the N. Y. Academy of Sciences, speaker in the first of a series of Cooper Union meetings on the subject: "The Electrical Industry Faces the Nuclear Age." However, his picture of people living in small communities, each built up around a reactor furnishing electrical power at almost no cost at all--is suspect, if only because of his explanation--that such near "free" power would need to be produced by the government, "since private capital would be insufficient to meet the vast capital outlay required."

PROPOSALS TO THE AEC are to be re-viewed "immediately" by the Commission's Reactor Development Division, instead of only twice a year by a Board set up in 1958 to stimulate the development of

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new reactor systems. Of 12 unsolicited proposals submitted by 10 companies (none utilities) in the six months prior to Mar. 1, only one was selected: American Radiator's proposal to continue analysis of the mercury-cooled breeder reactor's core stability.

AEC's REACTOR SAFEGUARDS committee says the vapor suppression system of containment proposed by PG&E for its 200-megawatt Humboldt Bay plant has not been proved safe as yet. (See "Nuclear News," page 63.)

YOUTH CONFERENCE ON THE ATOM, to be held in Chicago in Oct., will draw more than 600, with delegates from at least 60 utilities, according to PIP.

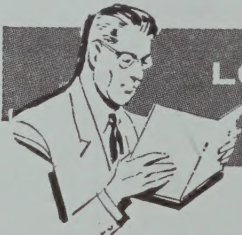
"SUPER-SUPER" COMPUTERS will control electrical power for the entire nation, if the dream of Daystrom's Pres. Thomas R. Jones comes true. He envisions all power plants in the U. S. as computer-operated, with systems or groupings controlled by "super-computers". . . on top of which there would be "one or several super-super computers, to switch power from one system to another as needed or as emergency conditions demand."

LABOR'S VIEW ON AUTOMATION?--"No worker is to receive less money or lose his job because of it." This policy-goal has been adopted by the United Electrical, Radio and Machine Workers Union for negotiations coming up with GE and Westinghouse on contracts (covering about 57,000 employees) expiring in October.

WATER HEATER-PROMOTION underway in NEMA's "second year of intensive pub-

licity" aims at enlisting the efforts of more than the 115 utilities which tied in locally in '59 . . . and at selling over 750,000 units, about the industry's total volume of last year. But, in this load, says Westinghouse, "there is cause for concern, and vigorous activity" is needed, for in 1959 the electrical industry "lost" a total of 350,000 units since there was a decrease in shipments of electric units of 65,500 while 282,-600 more water heaters were shipped.

UTILITY COMMISSION ENGINEERS will meet next month (May 17-19 in Boston) under the sponsorship of the NARUC for the first time. The National Bureau of Standards sponsored 38 previous annual conferences.



LOOKING AHEAD... FINANCIALLY

--From Irving Trust

New money financing for past quarter at \$538,419,000 was down 24-percent from similar period in 1959.

Volume in March of \$119,336,000 (92-percent electric) was the lowest monthly total in over 2 years. No AAA rated issues were brought to market in March.

Only three AA offerings and two A issues were made last month, and except for a small privately placed preferred issue, companies avoided this avenue of financing in March.

Three issues of common were offered in March all via rights.

Prices rose for the third successive month on seasoned electric company bonds and on preferreds rose and for the second month on outstanding commons.

THE IRVING TRUST		February 29, 1960		March 31, 1960	
INDEXES SHOW:		% Yield to Maturity			
Bond Averages					
"Aaa"					
		4.65		4.49	
		4.67		4.50	
		4.85		4.67	
Stock Averages		Common—\$ Yield		Price/Earnings Ratio	
		2/29/60	3/31/60	2/29/60	3/31/60
		4.91	4.87	17.3	17.5
		5.05	5.03	17.0	17.6
		5.14	5.07	15.9	16.1

NRECA Survey Shows

Billion Dollar Appliance Market Down on the Farm

Rural families now represent a market of more than one-billion dollars a year for a list of 20 selected major appliances, a recently completed survey by the National Rural Electric Cooperative Association indicates. NRECA conducted the study with the cooperation of 200 of its 957-member systems.

NRECA released information from the survey in conjunction with its efforts to commemorate, in 1960, "the 25th anniversary of the beginning of America's rural electrification program." The quarter-century event marks the anniversary of Pres. Franklin D. Roosevelt's Executive Order 7037, creating the Rural Electrification Administration.

In the years since, rural consumption of electricity has climbed 'spectacularly,' says the NRECA, noting a monthly consumption average of over 300-kwh per farm per month in 1959. (Editor's note: At the beginning of 1959, EEI recorded the annual kwh-per-customer consumption as 4,428 on farms east of the 100th Meridian; and 8,435 on farms west of the 100th Meridian, where irrigation may be involved.)

Among member-consumers of NRECA rural electric systems, these projected purchases of appliances (from the list of 20 major products checked) in 1960 are indicated by the Association's survey:

1. Electric refrigerators may be purchased by over 558,000 persons
2. Electric water heaters are on the shopping lists of 579,000
3. Electric frying pan purchases are anticipated by 554,000
4. Television sets may be bought by some 445,000 farm families.

Comments NRECA's Clyde Ellis: "The possibilities for new uses of electricity, electrical appliances

and equipment seem virtually unlimited. We have always vigorously promoted power use. Large, per-meter consumption helps the rural co-op to operate more efficiently and at a lower cost per kilowatt hour than would otherwise be possible."

However, far more important than these figures, in Ellis' opinion, is "the effect of rural electricity in human terms." As the NRECA general manager sees it: "Although city dwellers had long had the benefits of electricity—some for decades—not until an understanding Congress established REA to finance the self-help rural electrics did the darkness recede from the nation's farms."

Inside Story of "Kilowatt" Car

Henney engineers at the SEE annual meeting explained the new features of the Kilowatt, which utilizes the ingenious small-car body design of the four-door Renault Dauphine with the rear seat removed to make room for the control.

A new stepless type controller—for varying the voltage that goes to the traction-type motor and in turn the speed of the car—was jointly designed by General Electric, the Atlantic City Electric Company and Eureka Williams. It was made by General Electric.

The car is powered by heavy-duty batteries. Henney engineers found by tests that a number of small batteries were more efficient than a few large ones.

The top speed of the Kilowatt is 35 miles an hour.

The range is flexible, about 40 miles a day if run constantly and 50 to 60 miles if operated at moderate speed with frequent stops. The batteries regenerate to some extent during stops of 15 minutes or longer. They can be fully recharged overnight by plugging into any 110-volt or 220-volt outlet.

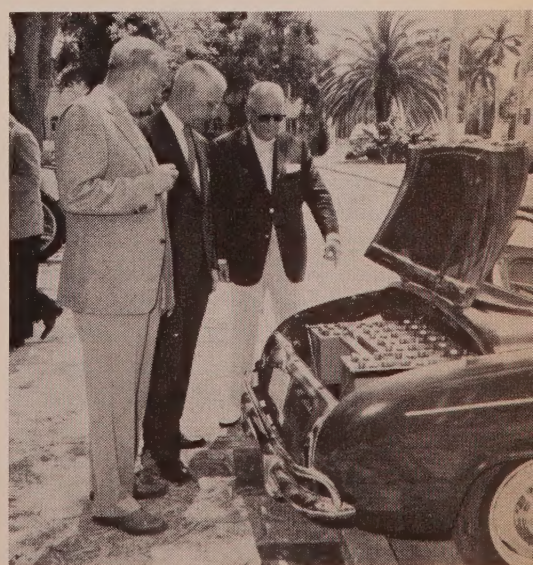
Now, Will Utilities Plug Electric Cars?

Is the market already waiting for the electric auto?

"The feeling grows that it is," suggested Atlantic City Electric's Carl O. Carlson at the annual meeting of the Southeastern Electric Exchange last month. A "new" electric auto he had in mind, of course, was the Henney Kilowatt (from Henney Motor Division of the Eureka Williams Corp., which engineered it), unveiled and demonstrated for the first time at the SEE conference. The Kilowatt is a brain child of the Atlantic City utility's Chairman B. L. England.

With enough interest displayed by the electric utilities, predicts Mr. Carlson, some manufacturer can break the barriers: too high a price, too heavy and short-lived a battery. And, he added, the challenge at this time to produce a highly desirable off-peak load as

Debut of "Henney-Kilowatt" at SEE Conference saw Consultant H. D. Harkins, Utilityman C. O. Carlson and Car Builder C. R. Feldman point to electric car's "heart"—and problem center: batteries, which the customer may view as too heavy and short-lived. (In the rear: 18 two-volt batteries; in the front: 18 more.)



soon as possible by means of the electric car would require a trivial expenditure of money compared with the millions of dollars being spent by utilities and manufacturers in meeting the challenge to produce an atomic reactor to be competitive ultimately in producing steam for turbines.

Mr. Carlson asked and answered the question: Why should the electric companies become interested in an electric car?

"From tests which have been made on one car, each two miles of driving will require 1 kwhr of battery charging. So, cars running 6,000-7,000 miles per year will require 3,000-3,500 kwhrs. Since the batteries will be on charge during the night, the individual demand of about 1.75 kw may be no more than .25 kw on the system peak. Our company's residential average annual kwhr use is now slightly over 3,500. Each car would be equivalent to one more residential customer. But, where we would anticipate an additional capital investment of \$400 for the residence, the peak effect of the electric car would require only \$100."

Mr. England, for some time, has been convinced that a renaissance of the electric car for urban use would provide an important outlet for current for recharging in the hours when the load is low. A study made of the practicality of using the electric car for short hauls in the utility industry estimates that the 258 electric utilities could use 10,000 or more small battery-

powered cars in urban areas for its meter readers, collectors, salesmen and home service girls.

The study of the utility industry's requirements for an electric car was made for Mr. England by H. Drake Harkins, consultant to the Atlantic City Electric Company. His report said:

"An analysis of the needs and usage of two classes of auto users has been made. It indicates that an electric auto with a top speed of 35 miles per hour and a range in city traffic of 35 to 40 miles in an eight-hour day will be satisfactory. A study made by the Atlantic City Electric Company shows that 25-percent of their passenger autos need not exceed this specification.

"No accurate data exist on the size of the nation-wide utility fleet. An estimate of 10,000 electrics appears a conservative number for utility application and it is certainly less than 25-percent of their total.

"What a wonderful spot for promotion," proposed Mr. Carlson. "It should start with the utilities."

The Kilowatt is dedicated to the utility industry and none will be sold to the public by Henney, its promoters have indicated. Tentative orders were placed for 76 of the cars in advance of production at \$3,500 each. Henney expects to be able to reduce this price when production is in the hundreds.

But, much experience and research is needed to perfect an electric car, acknowledged Mr. Carlson.

An automobile powered by sunshine was exhibited in Chicago for the first time during the American Power Conference, March 29 through 31. The sun-powered car, a 1912 Baker electric, was adapted to utilize solar energy by International Rectifier Corp. of California. The car has 10,000 silicon solar cells mounted on its roof in a detachable 26-square-foot panel. Sunlight energizes electrons in the cells which charge car's 72-volt battery system.

"Here is where the utility companies can help," he points out. "Buy one or two of the first run of these cars and put them to use in your operations. The data accumulated under recorded operational runs will be the basis for determining the final design and feasibility of an electric car. You will be engaged in a research project and, as such, the total cost can be charged to expense."

Mr. England and others in the utility industry predict that in time there will be a strong consumer demand for the car and that it will be marketed by the utilities much as they now sell electric ranges and other appliances.

The study report made for Atlantic City Electric Company concludes: "It has sales appeal and will be commercial when made in sufficient quantity to sell for \$1.00 per pound. This day is not far off. But, don't wait for the miracle battery and electric autos with a range of 100 miles at 55 mph!"

Plan New Long Beach Office For So. Cal. Edison Branch

Southern California Edison Company has begun construction of a 10-story branch office building in Long Beach, at a cost of \$4,800,000. Completion is scheduled for mid-summer of 1961.

Edison will occupy three of the ten floors, leaving more than 60,000 square feet of fully air conditioned office space available for lease by business and professional firms.

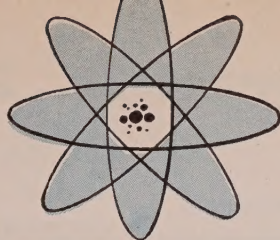
The structure, which will be owned and leased by an Edison subsidiary—Associated Southern Investment Company—will have an entrance court off Long Beach

Boulevard. It will be elaborately landscaped and will be enhanced by a reflecting pool and fountain.

Features of the office building will include high intensity lighting, complete climate control through the use of an electric heat pump system, a multi-level parking facility for tenants and a 150-seat Electric Living Center in which Edison's home economists will assist homemakers in kitchen design and demonstrate the advantages of Medallion homes. The ground level will be occupied by an all-transistor computing system capable of preparing and processing all the accounting and billing for approximately one million customers.



By mid-'60 So. Calif. Edison's Long Beach branch will move here.



NEW MANAGEMENT INFORMATION was insufficient in the past year to justify the presentation of a separately-sponsored NICB conference as part of this year's Nuclear Congress and Exposition (held early this month in N. Y. C.). The Conference Board cooperated in staging the big nuclear week, but decided not to repeat the special type of management program it has sponsored for the past several years.

COMPETITIVE" A-POWER—WHEN? From testimony at the Congressional hearings you could gain the impression that time is nearer (as in the estimates of costs for the two proposed plants on the PG&E and So. Calif. Edison systems) . . . or, from such a statement as Adm. Rickover's in a recent TV appearance, you could agree with him that economically competitive nuclear power is "at least 10, perhaps 20 years" away. Cost estimates on the proposed California projects anticipate the possibility of reaching the "competitive" status on the basis of average costs calculated over their lifetimes, however, so the "when" remains somewhat nebulous.

NEW SHIPPINGPORT CORE, planned for the higher power equivalent to 150-emw, would not have been necessary, in the unanimous opinion of an ad hoc advisory committee set up by the AEC. Information to be gained from a 100-emw core (for which generating equipment is already installed) would be technically sufficient, the committee concluded. (In asking Congress for new funds to carry out the new core project, Adm. Rickover described the need for using a heat sink to dissipate excess steam to the atmosphere; and complimented Duquesne Light Co. as a "most generous" contractor for putting up \$20-million for the existing generating facilities.)

FUEL FABRICATION OVERCAPACITY in the nuclear industry's manufacturing facilities was pointed out to the Joint Congressional Committee by Texas Instruments' P. E. Haggerty. Existing plants involved in the naval propulsion program could manufacture all the fuel needed in the next 5-10 years for industrial nuclear power generating facilities, he indicated. Meanwhile, the overcapacity condition discourages research and development effort aimed at reducing the cost of fuel fabrication, he warned.

HALLAM, NEB., REACTOR, though AEC-owned, was the subject of a Commission hearing early this month to consider safety aspects, just as private projects are reviewed in license proceedings. (GE's Atomic Power Equipment Division announced it will build the nuclear instrumentation for the 75-mw power station.)

PG&E'S HUMBOLDT BAY PLANT was also scheduled for review in an AEC public hearing in mid-April. But, before the Commission had issued a public announcement on the report of its Reactor Safeguards Committee, the California Dept. of Industrial Relations informed the Commission that it believes the suppression system of containment proposed for the PG&E reactor has only a "50-percent chance of containing a reactor failure and is not adequate to protect the employees and public from credible accidents." At the same time the state agency acknowledged that "the suppression system has many advantages over conventional containment, other than economic ones."

ALASKA'S CHUGACH CO-OP plans no further activity in the nuclear field, according to the Atomic Industrial Forum. Responding to a query from the AIF, the Anchorage Electric Association indicated it had no intention to accept the AEC's offer to assist the co-op in constructing an alternative reactor to replace the abandoned project for building a sodium-cooled, heavy water moderated reactor.

FUEL ELEMENT SHIPPING REGULATION, published by the AEC in the Federal Register in mid-month, proposed that licensees wanting to transport irradiated fuel elements must submit to the Commission engineering drawings and technical data indicating the safety of the casks from the standpoint of criticality, heat transfer, shielding and structural integrity. To prevent melt-down, fuel elements can be shipped only after they have cooled long enough to assure that when the casks are unloaded maximum temperatures of the fuel elements will remain well below melting points.

CARBON AND LOW-ALLOY STEELS may be practical for use in nuclear power plants, GE and U.S. Steel scientists reported to a recent meeting of the National Association of Corrosion Engineers. Their findings are based on results of the first phase of the first large-scale investigation of corrosion effects on steel wholly financed by private industry. In a boiling water reactor environment, they revealed, corrosion rates of such inexpensive steel remain remarkably low, because a protective corrosion-inhibiting oxide film forms from the action of the gaseous oxygen and hydrogen present in the BWR system.

EFFECT ON WATER RESOURCES of the requirements and applications of nuclear energy is unlikely to be significant in the next 20 years, the AEC reported to the Senate Select Committee on National Water resources. This is true from the standpoint of water requirements, waste contamination and desalination.

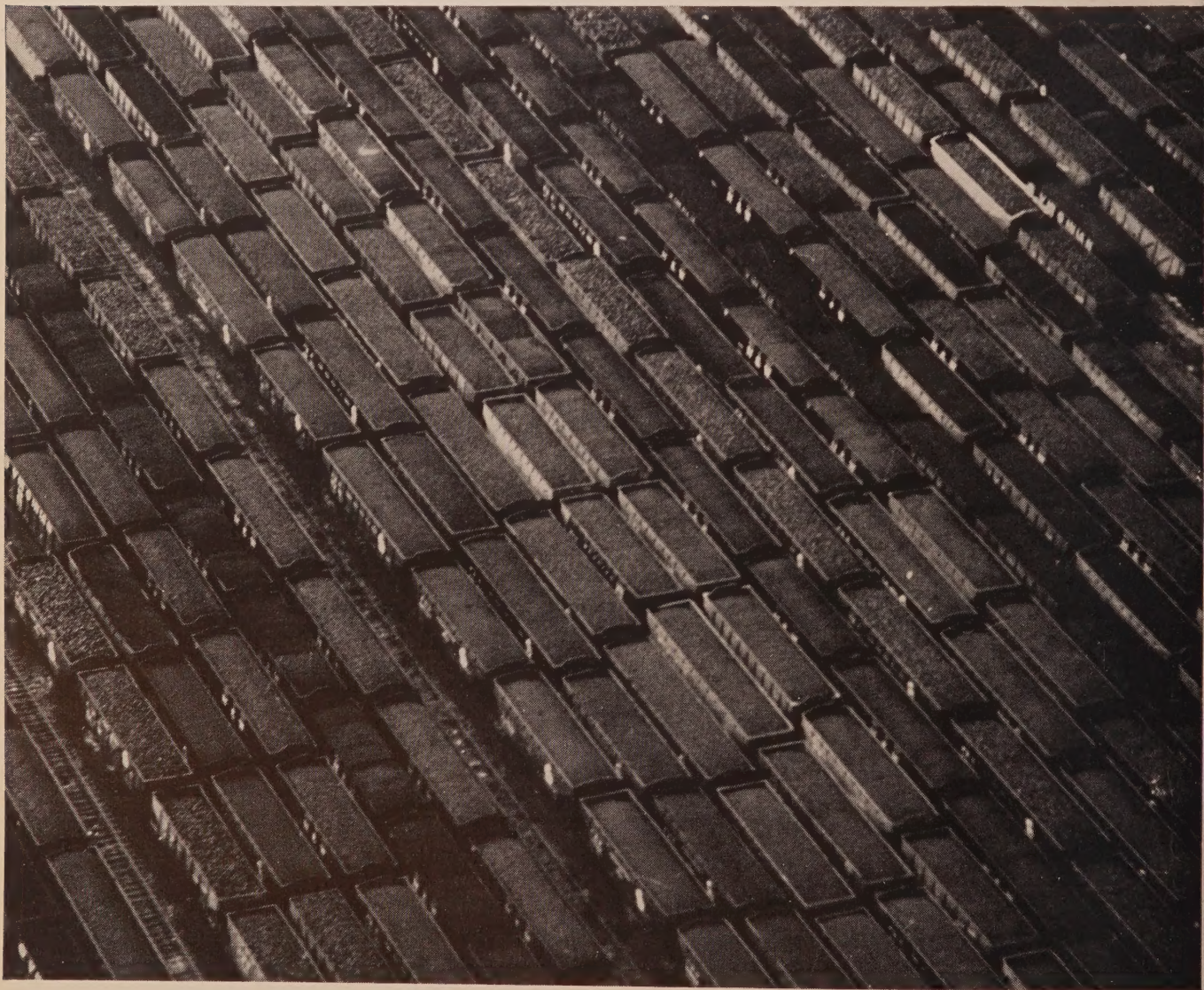
how long?...10 years?...20?...50?

(A utility needs to know!)

There has never been much room for short-term thinking in the utility business. But probably never before have utility executives and engineers been taking the *long look* in so many operating areas.

Take coal, for instance. They've been asking themselves and their coal suppliers some pointed questions: "Can we count on these suppliers to deliver the kind and quantity of coal we're going to need in the years ahead? Have they adequate reserves?

Is this coal costing us over and above its invoice price in excessive coal handling, ash handling, equipment outages, freight charges on inerts? Or is it coal that eliminates these frequently overlooked incremental costs, delivers highest operating efficiency and steam at the lowest cost?" The answers you'll get to such questions from Island Creek are the kind that let you plan ahead with confidence. We at Island Creek would welcome a chance to sit down with you for a thoroughgoing discussion. Write, wire or phone.



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by RALPH ELLIOTT
Washington Editor

Nez Perce—A Potential Backfire

In their latest maneuver to obstruct private hydroelectric development on the Middle Snake River, public power forces of the Pacific Northwest have bared some of their true, and not very pretty, colors.

The background and timing of the Nez Perce license application filed last month by a band of public utility districts readily blend into one clear picture: a callous disregard for both the needs of the local economy and the general public interest, all in the name of public ownership.

The Nez Perce application was filed with the Federal Power Commission by 13 Washington PUD's, organized as the Washington Public Power Supply System. Its purpose obviously is to torpedo Pacific Northwest Power Co.'s proposed High Mountain Sheep project. Already the PUD's have accomplished one long delay in the FPC hearing on the PNP application, which had been set for March 21. Now, as a party-applicant, they are in a position to heave more monkey wrenches into the proceedings. Since either project would preclude construction of the other, FPC had no alternative but to grant the request by the PUD's that the two applications be consolidated for hearing.

For those familiar with the history of the Snake River development controversy, the real implications of the Nez Perce filing are apparent with the mere mention of the fact that behind it are the more fanatically partisan remnants of the old National Hells Canyon Association; that playing the leadership role is Gus Norwood, a big wheel in the Northwest Public Power Association and long the top vocalist for federal construction of the Nez Perce project. The PUD application can be put into more

precise perspective, however, by piecing together certain developments in the past couple of years.

Back in January 1958 when FPC turned down PNP's proposal to build the low Mountain Sheep-Pleasant Valley project, it held, largely on the basis of Army Engineer reports, that the most comprehensive development of the Snake could be attained only with Nez Perce. The Commission didn't seem too concerned about the fact that Nez Perce, being some 2.5 miles below where the Salmon River empties into the Snake, would block the big Columbia fish runs that use the Salmon for spawning; or that no device was even in sight for safely passing migratory fish at such a high dam. It shrugged off the fish problem by saying it was no greater than many other engineering problems at high dams. And it virtually invited the company to seek a license for that project.

But PNP was having no part of the kind of headache Nez Perce would produce. Moreover, power was needed much sooner than the "someday" when the fish problem might be solved. So instead, it applied for a license for High Mountain Sheep, to be located a half a mile upstream from the Salmon. The project would include a 690-foot high dam, ultimate capacity of nearly 2-million kw, and would cost about \$250 million.

Faced with this threat to Nez Perce, the public power people came up early last year with a cute delaying gimmick. They proposed a 5-year moratorium on dam construction on the Snake or its main tributaries to allow time for a "crash" program to solve the fish passage problems. A concurrent resolution (S. Con. Res. 35) to that end was co-sponsored by seven Democratic Senators from the Northwest. Fish conservation inter-

ests at first thought it was a great idea, but soon realized they had been drawn unwittingly into supporting just a public power stratagem. And they let Capitol Hill know how they felt. The result: a second bill (S. 2586) by two of the above co-sponsors, which would prohibit high dam construction on the Salmon, or the flooding of "established spawning grounds." (Nez Perce would flood out much of the Salmon spawning area.)

During hearings in the Northwest last November on both measures, fish conservation organizations almost unanimously condemned S. Con. Res. 35 and supported S. 2586. Public power representatives pressed for the former measure as being the only real salvation for the fish. But they knew this little strategy game was about over, and were already thinking about their next move.

It wasn't long before a cluster of developments prodded them into less thinking and more planning. In January the Corps of Engineers reported on its exhaustive re-study of the Columbia Basin. Instead of favoring Nez Perce, as in previous years, the report recommended early construction of High Mountain Sheep and later construction of Lower Canyon Dam on the Salmon, after the fish problem is solved. Since it may take from 15 to 20 years to solve that problem, the Corps held, the benefits to be realized from High Mountain Sheep during the delay period "would outweigh the economic superiority of the Nez Perce project." (See EL&P March 1 issue, page 46.)

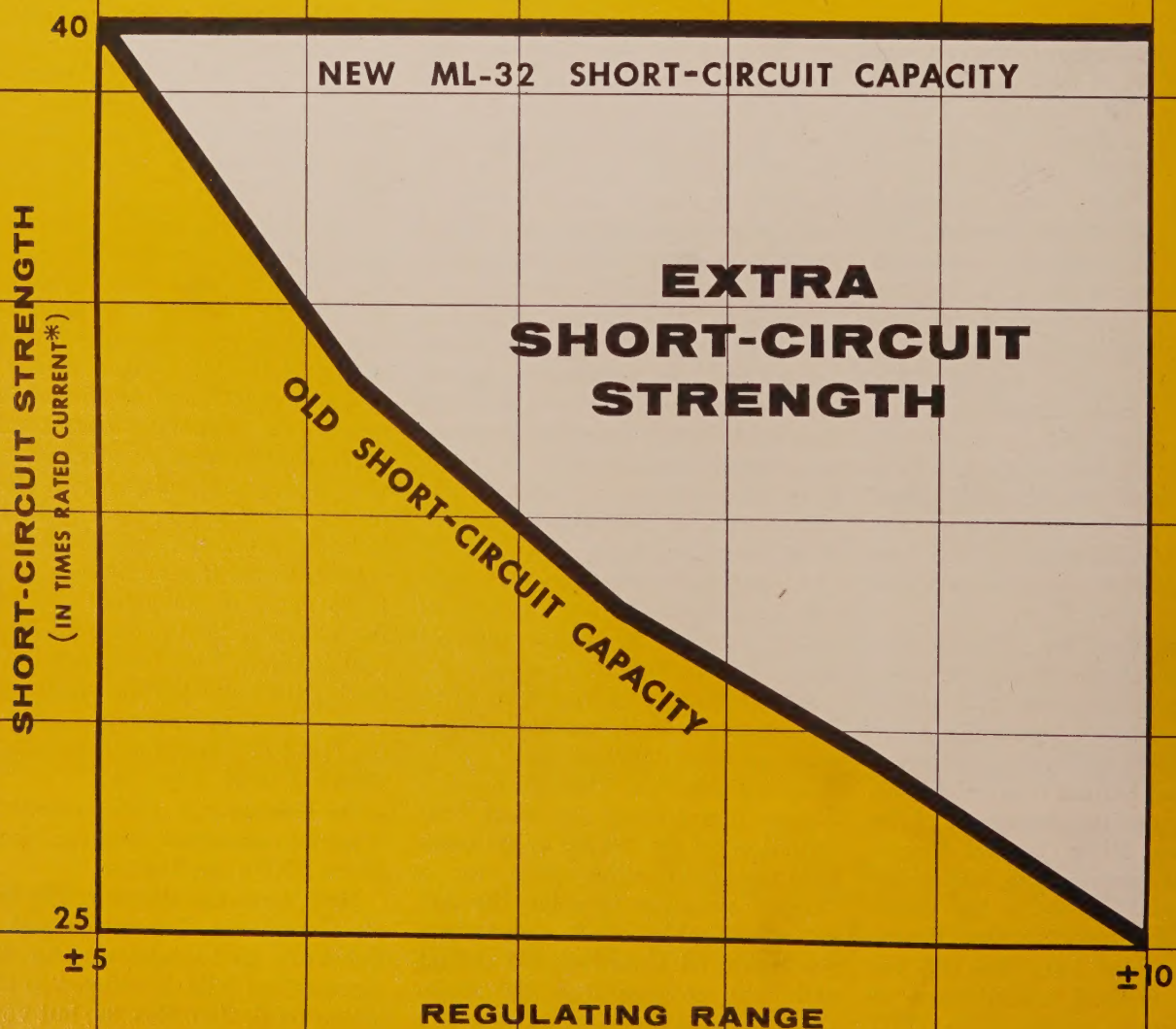
On February 1, FPC announced it would commence hearings March 21 on PNP's application.

Next came the clincher. The Senate Commerce Committee met on February 26 to take up the dam moratorium bills. It refused to take action on S. Con. Res. 35, but voted

(Continued on page 73)

NOW STANDARD ON ALL GENERAL ELECTRIC

40 times rated current* short



* Rated current is the nameplate current at $\pm 10\%$ regulation.



circuit strength

New, stronger coil windings of General Electric single-phase ML-32 step voltage regulators will now withstand short-circuit currents of 40-times basic nameplate rating (the basic current rating at $\pm 10\%$ regulation) at all Load Bonus positions.

This increased short-circuit capacity is available for a duration of 0.8 seconds (48 cycles). With modern breakers, this time period gives ample leeway to detect a fault and de-energize the circuit.

Additional strength to resist high-current forces means increased protection against service outage under all current loads, plus even longer dependable life for already superior General Electric voltage regulators. Both of these important benefits are now available in G-E regulators at no increase in price.

These service extras are now possible because of the following G-E design improvements:

- **TIGHTER WINDINGS**—new coil winding process provides tighter, even coils; inherently stronger, better able

to resist coil movement caused by short-circuit stresses.

- **SPECIAL INSULATION**—specially treated layer insulation forms a stronger winding-to-winding bond for finished coil. Additional protection added at points of most-severe stress to further resist coil shifting.

- **CONTROLLED DUCT SPACING**—cooling duct spacers are accurately positioned to hold windings firmly in place against radial forces during short circuits.

- **BALANCED WINDINGS**—coils are precisely aligned to resist destructive forces caused by short circuits.

This new high standard for voltage regulators is another dividend you receive from G-E research.

To learn more about all the reasons why G-E Voltage Regulators Cost Less on the Line, contact your nearby General Electric Apparatus Sales Office or Agent. Or write for Bulletin GED-3905, General Electric Company, Section 423-41, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL  ELECTRIC



RUGGED COIL wound by new process provides stronger resistance to forces caused by high short-circuit current.



SPECIAL INSULATION strengthens coil by stronger winding-to-winding bond, resists movement caused by short-circuit currents.

EXTRA REGULATOR STRENGTH
(for a typical ML-32 100-ampere unit)

Regulating Range	Current Range	Former Short-circuit Capacity	NEW Short-circuit Capacity
$\pm 10\%$	100 amp (normal)	2500 amp	4000 amp
$\pm 8\frac{3}{4}\%$	110 amp (load bonus)	2750 amp	4000 amp
$\pm 7\frac{1}{2}\%$	120 amp (load bonus)	3000 amp	4000 amp
$\pm 6\frac{1}{4}\%$	135 amp (load bonus)	3375 amp	4000 amp
$\pm 5\%$	160 amp (load bonus)	4000 amp	4000 amp



An Appraisal of the New SEC Regulations on the Treatment of Tax Deferrals

This statement of Administrative Policy of the Securities & Exchange Commission as to the Balance Sheet Treatment of Deferred Federal Income Taxes raises a number of important and controversial issues.

The Commission's Statement

The statement said in part that: "It pertains to the propriety of designating as earned surplus (or its equivalent) or *in any manner as a part of equity capital*,* in financial statements filed with this Commission, the accumulated credit arising from accounting for reductions in income taxes for *various items**, including those under Section 167 (liberalized depreciation) and Section 168 (accelerated amortization of emergency facilities) of the Internal Revenue Code of 1954. It is not intended to direct or establish any system of accounts or to specify the manner in which a particular item shall be recorded on the books of the reporting companies, nor is it intended in any way to affect the requirements of any other governmental agency, federal or state, with respect to the manner in which such books of account shall be kept."

Comment

The question that might well be asked here is just how many different types of reports will a Company have to make that is regulated both by a State regulatory commission and the SEC. There would appear to be enough problems accounting-wise between State and Federal jurisdictions without adding any new ones. It could be construed from the above statement that those companies that use actual taxes and do not normalize would also be subject to

the Commission's treatment of liberalized depreciation. This, however, is not so, since the Commission states in Footnote No. 4 that: "It is the understanding of this Commission that the exception recognizes the position of those regulatory agencies which permit public utilities to deduct only the actual taxes payable in a given year, and the Commission raises no question as to the propriety of the exception."

The Commission's Statement

"Because of the interrelationship between income taxes and depreciation, the Commission is of the view that in the earlier years the charge equivalent to the tax reduction should be treated either (1) as a provision for future taxes in the income statement with a corresponding credit in the balance sheet to a non-equity caption such as a deferred tax credit, or (2) as *additional depreciation in the income statement** with a corresponding addition to the accumulated provision for depreciation in the balance sheet. In the Commission's view it is improper to charge income with an item required for the proper determination of net income and concurrently to credit earned surplus.

"A number of comments indicated that, should the Commission take the foregoing position, it should be limited to matters connected with depreciation and amortization or, if not so limited, *any additional items embraced within this principle should be clearly specified*.* It is the Commission's view, however, that comparable recognition of tax deferment *should be made in all cases in which there is a tax reduction resulting from deducting costs for tax purposes at faster rates than for financial statement purposes*.*"

Comment

Presumably Part 2 of the above quote would only be applicable to industrial concerns where accounting and the determination of the cost of service does not set the price of the product. The Commission also makes clear its position that it does not consider a deferral as being a part of income, and hence it objects to crediting the tax deferral to either earned or restricted surplus as some utilities do.

A problem of major importance which the foregoing decision raises is the ultimate disposition of amounts currently lodged in restricted or appropriated surplus which were considered as part of earned surplus in the issuance of new securities, all with the knowledge and consent of the SEC. The SEC has seemingly taken note of this problem and dismissed it rather cavalierly in its Footnote No. 11 when it said:

"So far as this Commission is concerned, since it believes that classifying the item as a component part of common stock equity is misleading for financial statement purposes, it does not intend to consider the item as a part of common stock equity for analytical purposes, *although it may give consideration to the item as one of a number of relevant factors in appraising the overall financial condition of a company*.* The Commission, of course, does not have jurisdiction over rate-making, although under the Public Utility Holding Company Act of 1935 it is concerned with the interests of consumers. Alleged adverse results as to investors and consumers are no different from those complained of whenever any requirement designed to assure financial stability is imposed."

The second paragraph in the above statement makes it clear that

*Italics supplied

the Commission proposes to normalize and set up a reserve in all cases where costs for tax purposes are materially higher than those for financial statements. Presumably under this kind of concept utilities would be required to normalize capitalized pension costs, social security, and interest charged to construction. This would in some instances have a material effect on net income, unless such deferrals are allowed in the rate making process. In this connection it is of interest to note just how does the Commission propose to treat the historical differential between book and tax straight line depreciation accruals which existed in the electric utility industry for many years.

Finally, as to what the SEC intended to say in the underscored portion of Footnote No. 11, is not clear. While the sophisticated investor will doubtlessly understand the words, their meaning will totally escape him.

Conclusions

The end result of the SEC ruling may be far removed from the Commission's original intent which was to promulgate some accounting standards for the treatment of tax deferrals arising from the use of Sections 167 and 168 of the Internal Revenue Code of 1954.

The Commission's acceptance of the fact that the use of liberalized methods of computing tax depreciation creates a deferral and not a forgiveness of taxes is undoubtedly a step in the right direction. However, the Commission's ruling deals only with the balance sheet treatment of the deferral, and to that extent there is a serious lack of clarity in the regulations.

Furthermore, the SEC ruling may have pushed the utility industry further down the road towards the use of the "flow through" method than it suspects. This would be done in the hopes that for rate making purposes their State Commissions will permit earnings which would leave their own surplus position unchanged.

Such regulatory conflicts and uncertainties can be detrimental not only to investors and customers, but also to the public interest at large.

Canadian Utility Expanding—

EHV Saving Millions, Says Ontario Hydro

By pioneering "North America's first major 460,000-volt transmission line" circuits, Ontario Hydro expects to save millions of dollars transmitting large blocks of power from remote hydro-electric sites. Ontario Hydro Chairman James S. Duncan referred to the anticipated savings in announcing a \$182-million, six-year construction program involves three new generating stations in the James Bay watershed. *(Editor's note: Pennsylvania Electric Co. expects to energize a 13-mile prototype 460-kv line this summer—probably the first three-phase 460-kv line operating at full voltage and carrying power as part of an established power grid.)*

During the station-building program, some 450 miles of line will be constructed to form the extra-high-voltage system which will incorporate the output of these stations into Ontario Hydro's combined Northeastern and Southern Ontario systems. It will extend south as far as the Barrie area, and eventually as far as Toronto.

Station construction, along a 15-mile stretch of the Mattagami River will begin this spring on the southernmost plant at Little Long

Rapids. Ontario Hydro is already building a station at Otter Rapids on the Abitibi River which will be placed in service next year, and by 1966 the four stations in the Moose River System will have a total capacity estimated at 528,000-kw by 1966. They may be expanded later in Hydro's long-range program to harness Northeastern Ontario rivers which could yield about 1.5-million kw over the next 20 years.

Other utilities have shown keen interest in Hydro's EHV progress at the Coldwater Project near Orillia since tests began on a special line last summer.

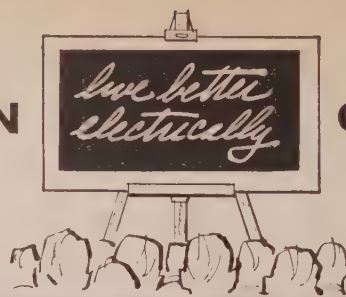
These tests are providing data previously unavailable, and painstaking studies have demonstrated that the six-year development plant incorporating EHV transmission will be more economic than equivalent thermal-electric generation, according to Ontario Hydro.

Power will be transmitted at 230 kv to a new terminal station near the existing Abitibi Canyon generating plant, about 230 miles north of Sudbury.

The line from this gathering point to the Sudbury area is scheduled for service in 1963 along with the first Mattagami plant and units 3 and 4 at Otter Rapids. It will be designed for 460 kv, but will operate at 230 kv until the second Mattagami station starts up in 1965.

Winter didn't thwart construction men building Ontario Hydro's Otter Rapids plant on the Abitibi river—part of Canadian utility's potential 20-year program that may yield some 1.5-million kw from Northeastern Ontario rivers. But, it was an "undercover" operation, with plywood and tarpaulin enclosing areas like this diversion port.





Industry's Place In Future Economy Highlights SEE Executive Conference

"If we are to take full advantage of the potentials of future growth in this industry, we must keep it part of the free enterprise system, and keep it alive and virile and develop young men of imagination to go into the business in the future." This is the warning voiced by Allen S. King, president, Edison Electric Institute, and president, Northern States Power Co.

Mr. King was speaking at the Southeastern Electric Exchange Annual Meeting, held at Boca Raton, Fla., Mar. 21-23. He warned that our greatest threat does not come from those who openly advocate socialization of the power industry but from real believers in free enterprise who say that the utilities are different. He expressed great concern that the people will support our government representatives in wrong ways for the future of our industry, and our free enterprise system, on the basis of gross misunderstandings of what their system has done for them.

We need to tell the people the things we are doing in the industry in this country—interesting things, romantic things, things that people would readily listen to, he declared.

The utility industry in the aggregate has not yet sold the people that 1929 is old history, he said, adding that "we should find a new way to paint a new corporate image for the industry as a whole that would be comparable to our local corporate images."

Companies in the Southeastern Electric Exchange will spend at least \$700-million per year for capital improvements for the next three years, reported Exchange President F. H. Coughlin (president, Central Louisiana Electric Co.). EEI's future power requirements study indicates that the electric energy requirements of the Exchange companies will increase more than 500% by 1980, he said, compared with about 400% for the nation as a whole.

Exchange companies whose particular areas have shown the largest industrial growth during the five-year period 1954 through 1959 included Florida Public Utilities (386%), Florida Power & Light (200%), Gulf States Utilities (96.6%), Gulf Power (84.9%), Virginia Electric Power (72%), Potomac Edison (69%), and Tampa Electric (67.5%).

Exciting Times Ahead

People have now come to think of electric power as a steady, stable, dependable industry, declared Mark W. Cresap, Jr., president of the Westinghouse Electric Corp., and yet these words give an essentially incomplete picture of the electric power industry today, in his opinion. "They do not describe an industry which thrives on new ideas and encourages revolutionary changes," he said. "They do not describe an industry which right now has more new, significant and exciting developments under way than at any other time in this century."

"We have a magnificent opportunity," Mr. Cresap pointed out, "to present the utilities to the eyes of the public as members of a progressive, research-minded industry"—an industry that has conducted a research program second to none in the nation. "This industry is not merely keeping up with the times in research," he said, "it is so far ahead of the times that it may truly be said to be *creating* the times."

Commenting on developments in direct-conversion technology, Mr. Cresap stated that by 1970, or thereabouts, Westinghouse expects to have developed the know-how to build a thermo-electric generator up to 100 mw sizes that utilities can buy for \$80 a kilowatt. It would have an over-all efficiency on the order of 20 percent, he reported, and would be nuclear-fired.

Mr. Cresap expressed confidence that perhaps ten to 20 years from now Westinghouse will be in a position to offer a fully-developed magneto-hydrodynamics generator in hundreds of megawatts capacity. Thermionic power generation, at least in the 100-watt range, is expected within two or three years. If the problems with the fuel cell are solved, as they may be within



Opening session speakers and chairman at SEE Conference include (l to r) seated—Allen S. King, Hon. Ernest F. Hollings, Mark Cresap; standing, W. J. Clapp, F. H. Coughlin and S. C. McMeekin.

ten to 20 years, he said, we may look to the high-temperature fuel cell to play a significant role in the large-scale generation of power.

most co-operation by the state regulatory authorities, Mr. Stathas declared, so that the utilities will remain financially healthy.

When it has been done, it has all too often been looked upon as something "in addition" to the regular work of conducting a business and attention has been focused on relations requirements only when a crisis exists, he said. One of our most critical needs is understanding and reasserting the mutual interest of employees and business. All those concerned with "labor-management relations" must develop greater skills in achieving mutual acceptance of conditions that recognize the needs of business—for meeting these needs must reflect to the benefit of all associated with the business as individuals, Parker stated.

Public Responsibilities Vital

Electric utilities must stir up the public on public power and make them feel strongly on this subject in order to make Congress listen, said J. C. Bevis, chairman of the board, Opinion Research Corp. One of the industry's difficulties is that people don't care much about the issue of public power and it is of little importance to them, he stated. Sixty-three percent of the people today are unaware even of the fact that the federal government is in the power business. This is 6 percent below the proportion found two years ago, Bevis said. Seven percent more today than two years ago say they are affected by government power, he claimed.

Bruce Palmer, president, Mutual Benefit Life Insurance Co., discussed the responsibility of business in public affairs. He urged that utility executives take a more active part in politics—not necessarily running for office—but working for a political party as committeemen, precinct captains, ward leaders, etc. He said that more business men should take courses in politics sim-

The Outlook For Business

Heavier capital spending ought to go a long way toward cushioning the effect of a decline in inventory accumulation, observed John D. Wilson, vice-president of The Chase Manhattan Bank. Outlays on plant and equipment in the first quarter of 1960 are estimated at an annual rate of approximately \$35-billion, a healthy rise even since the autumn months, he reported.

Moreover, Mr. Wilson said, the previous peak rate of \$37-billion (reached in 1957) is expected to be passed by mid-year, while further gains stretching into 1961 seem probable.

This year total outlays for research and development are expected to top \$12-billion, six times the rate of expenditure in the early postwar years, Mr. Wilson noted. "In many respects," he said, "we stand today only on the threshold of the age of science: nine-tenths of all the scientists who ever lived are said to be alive today."

Speaking on the outlook for utility financing, P. P. Stathas, president of Duff and Phelps, Inc., warned that utility managements, and particularly their financial officers, must give more thought than ever before to selecting the best means of raising the huge amounts of additional capital that will be required during the next ten years.

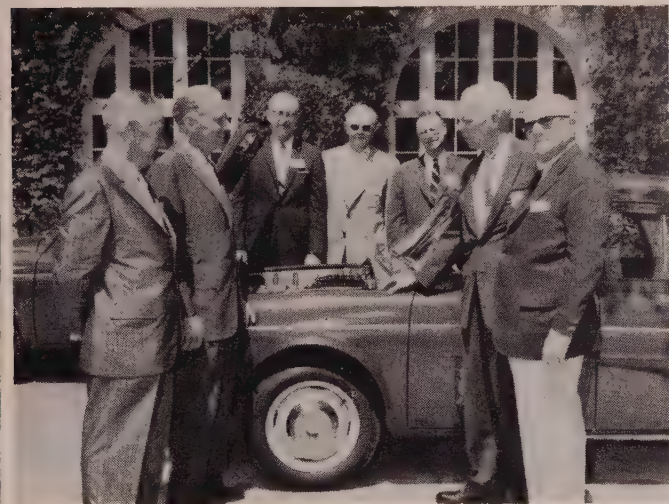
The next decade also calls for a continuing realistic attitude and ut-

Relations Get Top Attention

The stockholder relations program of Wisconsin Power & Light Co. has proved to be sound and effective for the past 26 years, according to Carl J. Forsberg, president of the Company. The program has proven itself comparable in effectiveness to the Company's sales program and management training program, he said. It has helped to improve the home ownership of the Company's common stock—from 18½ percent in 1948 to 65½ percent in 1960. The Company also received enthusiastic and valuable voluntary support from stockholders in the numerous municipal acquisition elections and this was in considerable measure responsible for their defeat in many of 22 contests. Not a single election was lost, Forsberg stated.

Corporate relations has been the neglected function of business, according to Jack S. Parker, vice president, General Electric Co.

Second-session speakers and chairman examine the new electric automobile, the Henney Kilowatt, displayed and demonstrated at the SEE Conference by the Eureka Williams Corp.



Three of the third-session speakers and chairman are, from left, Bruce Palmer, Dr. George Benson, and O. J. Miller.



ilar to those given at Princeton University Workshops and predicted that in one year 500,000 will have completed their political education.

According to Dr. George S. Benson, president of Harding College, government is the most important human factor in freedom. He said that, today, the great crisis is to preserve freedom and that the

lighting, cooking, water heating will naturally follow, he stated. Wallace described the new Residential Wiring Plan of the Georgia Power Company, under which the Company pays \$50, \$70, \$100, \$120 or \$200 toward the installation of adequate service entrance facilities for new and existing homes and apartments—a substantial help in the cost of adequate wiring. He esti-

amount to \$1,594,039. Wallace reported that, after two months operation of the plan, there are 1374 jobs under contract and 584 jobs completed—a total of 1958 participants in the program.

Carl O. Carlson, executive vice president, Atlantic City Electric Co., described the very promising load building possibilities of electric automobiles. From tests made on one car, each two miles of driving will require 1 kwh of battery charging, he said. Cars running 6000 to 7000 miles per year will require 3000 to 3500 kwh. Since the batteries will be on charge during the night, the individual demand of about 1.75 kw may be no more than .25 kw on the system peak, he said. Each car would be equivalent to one more residential customer. But where the Company would anticipate an additional capital investment of \$400 for the residence, the peak effect of the electric car would require only \$100, Carlson stated. (For more details on the electric car see page 61.)

Several cars assembled by Eureka Williams Corp. of Bloomington, Ill., were shown and demonstrated at the Conference. Carlson said that 60–70 of them had already been ordered by utilities but that 100 to 150 orders would be needed to justify a pilot run. Payments would be made *only* upon delivery.



Newly elected SEE officers (l to r) J. W. Tally, executive director; J. J. McDonough, president, Georgia Power Co., third vice president; R. B. Wilson, president, Mississippi Power & Light Co., second vice president; W. C. MacInnes, president, Tampa Electric Co., president; O. J. Miller, executive vice president, Duke Power Co., first vice president.

1960s will decide whether we win or lose. The four major problems facing us today are: (1) International Communism which controls 40 percent of the world's population; (2) Our financial position, which is seriously weakened—we are spending ourselves into bankruptcy—we are in debt more than a trillion dollars; (3) Our industrial position—is being lost to foreign markets; (4) Lawlessness and juvenile delinquency—juvenile crime is up 800 percent in 10 years. Our only hope is a massive program of citizenship education at adult and academic level, he said. If we lose, the Communists will take over. If we win the stakes are very high—a 4 percent increase a year in productivity—world leadership—no 3rd world war.

Selling Tomorrow's Market

We cannot double our residential use per customer in the next 10 years—7000 kwh at the end of 1969, unless we capture the heating market—the total electric home, including electric heating and air-conditioning, or climate control, said C. M. Wallace, Jr., vice president, Georgia Power Co. If we get heating and cooling—climate control—as the *base load*, the other loads—

mated that the annual expenditures by Georgia Power in a normal year for the purchase of service entrance facilities will total \$2,955,860 and that the Company will realize \$1,337,604 as a result. However, in addition, the Company's estimated increase in distribution plant cost and administrative expenses will

First National Electric House Heating Symposium

Industry Acclaims Future of Electric Heat

The First National Electric House Heating Symposium and Exposition sponsored by NEMA in Chicago March 21-23 proved one thing—that every aspect of the electric and building trades is ready to ride the bandwagon of electric heat right into the American Home. The battle cry was six million electrically heated homes by the end of the 60's.

Symposium speakers representing utilities, manufacturers, distributors, builders, and trade associations of allied industries presented a complete round-up of the problems and the future for all concerned.

Attendance far surpassed all estimates by NEMA personnel. Original feelings were that an attendance of 500-700 would be exceptional. Final unofficial tabulations showed that total attendance for the three-day meeting and the exposition hit over 2900—better than four times the most optimistic hopes of its organizers.

Perhaps the biggest single contribution to come out of the meeting was the announcement of the National Mineral Wool Association to adopt a performance descriptive code for its insulating materials, rather than a long list of specifications which are hard to interpret in

actual applications.

Preceding the NMWA presentation, Paul Emler, vice president, American Electric Power Corp. stated that at this time, insulation, properly specified and installed, was the key to successful electric house heating. He pointed out that the 6-4-2 formula, generally agreed upon for electrically heated homes, has never been a true standard. Further, the weakness of the formula itself prevents efficient application because it does not define 6-4-2 of what. Different materials have different thermal characteristics. Also, insulation for electric heat and air conditioning in Minnesota or Maine could not be economically justified for a home in Louisiana or Texas.

To solve the problem, representatives of the glass, insulation, and equipment manufacturers, NEMA, NMWA, EEI and the utilities formed a committee which worked out the All Weather Comfort Standard for Electrically Heated and Air Conditioned Homes.

Performance New Key

"Performance is the key to the new Standard," said Mr. Emler—"performance measured two ways." The first is over-all performance—the Btu heat loss per square foot of area of the house, while the second is the thermal performance of the various individual structural parts (ceiling, walls, floors) of the structure. Flexibility thus gained permits adding more insulation in certain areas if the performance value for another part is below minimum.

F. H. Sides, Executive Officer, National Mineral Wool Association, told the group, how his organization quickly followed the adoption of the All Weather Comfort Standard with a Recommended Standard which describes the performance of an insulating material when properly installed in accordance with the manufacturer's specifications. This standard, denoted as R to indicate the Installed resistance, would take into consideration factors such as density, thickness, conductivity, the value of adjacent air space, and the direction of air flow.

Utility representatives presented several aspects on what electric heat means to the utility and how it can best be sold.

Experience of the Virginia Electric and Power Co. in the area of supplementary and auxiliary electric heating was described by C. E. Anderson, manager of sales promotion. He said that, in his opinion, every home in the country now heated with fossil fuel needs at least two kw of S&A electric heat to make it fully comfortable. This, he said, would mean that the utility potential is somewhere in the vicinity of 123-million kwh, with a revenue of more than \$2.25-million, if the load is calculated on a mid-range usage.

Control Discussed

In a discussion of control for electric house heating, R. L. Boyd of the Edwin L. Wiegand Co. pointed out that customers do not buy what is best, but rather what is SOLD. Both central systems and dispersed systems have their advantages, and whether or not single control from one thermostat or individual room control with multiple thermostats should be used will be decided by which type of system is SOLD to the customer.

As to the voltage for thermostats, Norman Boldt of the White-Rogers Co. said that at this time, line voltage thermostats have a better selection of models, they are lower cost, have lower installation cost and less wiring. Performance-wise, they are better on radiant heat systems. However, low voltage thermostats perform better where no radiant heat is present.

Control of humidity in electrically heated homes was presented by R. H. Luscombe of Penn Controls, Inc., as no particular problem. He pointed out that humidity does not vary significantly during the day in a well built home heated by electricity and that where a humidity problem should occur, installation of a humidistat working in conjunction with a ventilation fan solved the problem.

Speaking for the electrical distributors, W. C. Wallis of the Southern Supply Co. told the group that the proven successful method of merchandising electric heat is the teamwork of manufacturers, utilities, electrical supply distributors and the electrical contractors. He forwarded the idea expressed by others on the program that the

sale of electric heat must be done by all aspects of the electrical and building trades or the movement will fall far short of the goals set.

The contractors presented their problems and admitted that acceptance had been slow toward electric heating in the past. However, with support from their allies, and with proper education, they felt that electrical contractors would live up to their obligation to promote the concept of electric heat. To assist in this movement, the National Electrical Contractors Association is preparing plans for a National Institute for Contractor Sales Training.

Summing up the future for electric home heating, Stanley Aronson, Sales Manager of Berko Electric Mfg. Corp. predicted that the electric heating industry will push over the \$1-billion level sometime in the late 60's. Further, new competition will enter the market to produce greater growth and development. The key to the future remains the ability to produce and make available to buyers efficient, quality electric heating equipment. This, he said, NEMA members are dedicated to do.

Washington Outlook (Cont'd)

to report favorably on S. 2586. (Although up to this writing Chairman Magnuson has held up the report for some unaccountable reason.)

On March 1 the PUD organization notified FPC of its intention to file the Nez Perce application. It was filed March 15. The \$276 million project would include a 700-foot high dam and would have ultimate capacity of 2.4 million kw.

On March 16, FPC postponed indefinitely its scheduled Mountain Sheep hearing, due to the "conflicting" application by the PUD's.

Thus, having failed to roadblock the PNP proposal through legislation, the public power die-hards have resorted to their last available maneuver by shifting the battle arena from Capitol Hill to FPC, where they hope they will find less sensitivity to the welfare of the fish.

In all probability their action will backfire into a considerable wave of anti-public power feeling in the Northwest.



**BUY
A
ROTOR**



**INSTEAD
OF
A
ROAD**

Sikorsky helicopters eliminate costly road building completely. They fly men, materials, equipment right to remote construction sites. Used *both* as a highly maneuverable CRANE and a high-speed TRANSPORT, a Sikorsky helicopter can save months of road building . . . eliminate many right-of-way problems . . . reduce your total costs dramatically. Examples? In New Guinea, an oil company flies a complete drilling rig with men and supplies to jungle locations. Once an eighteen-month operation, the

entire job now takes just two months. In Puerto Rico's mountainous upcountry, a helicopter with three two-man ground crews can plant 100 power poles a day, three to four months' work with old construction methods. Savings in costs are from 70% to 80%. Want more facts on Sikorsky Aircraft "off-the-road" economies? Write us today.



A New World of Mobility by

SIKORSKY AIRCRAFT

Stratford, Connecticut / A Division of United Aircraft Corporation

Coal Unloading By One Tower Operator

A coal unloading tower with 1300-ton-per-hour free digging capacity will be erected this spring for Public Service Electric and Gas at the site of Mercer Generating Station near Trenton, N. J. The tower operator will control the entire coal unloading conveyor system. This includes monitoring and control of a rotary stacker by means of closed-circuit TV.

The tower, designed and engineered by Mead-Morrison Div. of McKiernan-Terry Corp., will be provided with a 92-ft raisable apron to permit unloading either ships or two 2500-ton barges moored abreast.

Hoist and close rope system for the tower's 12-ton lightweight alloy grab will be counterweighted, and will utilize the patented Mead-Morrison progressive reeving system. Progressive reeving is also utilized for the counterweight rope system.

Gulf States Hammers At Tube Corrosion

High mineral content in river water has been plaguing Gulf States Utilities in the form of increased deterioration in its condenser tubes. To minimize this deterioration, the company has considered these possibilities: (1) the use of high priced alloys; (2) the use of more effective inhibitors in cheap alloys; (3) avoid the use of river water; (4) chemical control of the river water to form a protective film within the condenser tubes, and (5) the elimination of the cause of the pollution and corrosion.

Sic Transit Gloria Tidd!

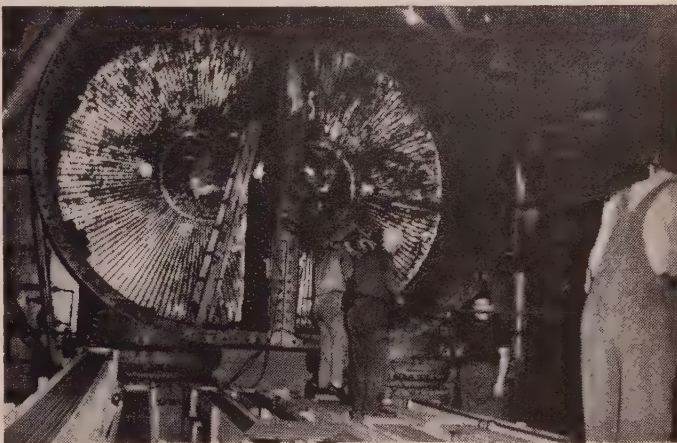
Removal of American Electric Power System's high-voltage test lines adjacent to Ohio Power Co.'s Tidd Plant at Brilliant, Ohio, marks the passing of 12 years' research on EHV. From research at Tidd came much of today's 345-kv transmission-line technology. Space occupied by the test facility will be used for a much-needed ash-storage area.

From the beginning, the Tidd research program was a cooperative venture combining the engineering skills and talents of both the AEP System and a group of leading manufacturers closely allied to our industry. It was a project which would have been virtually impossible for any one company to undertake alone and, because of the teamwork nature of the task and the success with which it met, all benefitted materially.

Removal of the laboratory involves dismantling of three transmission test lines, strung on a series of towers, as well as the necessary allied control and

testing equipment. It had been capable of testing up to 530-kv. Its work is now ended.

Retube Condensers, FAST



At a large eastern utility, a major condenser retubing job involved rolling 19,200 tube ends in a 65,000 sq ft surface condenser. The job was done by two men working three eight-hour shifts, which means that tube ends were rolled at the rate of nearly 400 an hour, or six per minute. The tubes were 7/8-in. OD x 14 gage x 30-ft long. The job was done by Cheney & Co., Inc., Jersey City, N. J., using "Tora-Air-Matic" tube expanding equipment by Thomas C. Wilson, Inc., Long Island City, N. Y. This automatic air-driven equipment gages tightness to a predetermined setting and stops expander rotation when this point is reached.

Scaled for the Future



The early future is scaled down in this model of a 357-mw steam turbine-generator unit scheduled for 1961 operation as No. 4 in Consolidated Edison's Astoria Station. On order for unit No. 5 is a duplicate machine. Both Allis-Chalmers units will have fully-supercharged generators on the 1800-rpm and 3600-rpm shaft systems and will operate on 2000 psig 1050/1000F steam exhaust pressure 2.0 in. Hg absolute. Boiler feed pumps will be driven by the high-speed shaft. Viewing the scale model at Allis-Chalmers' clubhouse are (from left) J. G. Noest and J. M. Driscoll, both of Con Ed, and J. H. Burrus of Allis-Chalmers.

COMPUTER AUTOMATICALLY ASSEMBLES ALL FAULT-CARD DATA

Cost and time savings have been realized through automatic computer assembly of fault-card data for forced outages on Baltimore Gas and Electric's transmission and distribution system.

By C. D. ALVEY,
Senior Engineer
Power Production Stations
Baltimore Gas and Electric Company

SPECIAL PROGRAMMING written by our company for the IBM Type 650 digital computer has greatly speeded preparation of our annual trouble analysis reports.

These reports furnish information useful to the engineers who plan, design, and operate the electric systems and, in addition, provide management with various measures of system performance. They have the following major objectives:

1. To provide an over-all picture of the faults which occurred during the year, their causes, and their effects on the system.
2. To show the major causes of outages.
3. To show the effects on performance of changes in line design.
4. To indicate which distribution feeders have the poorest service-continuity record so that corrective measures may be taken.

In order to accomplish these objectives, various tabulations are prepared for inclusion in the report, namely:

Tabulation I—Summary of Faults and Their Effect on the System

Tabulation II—Detailed Analysis of Faults by Cause

Tabulation III—Major Causes of Faults

Tabulation IV—4-Kv Feeders with the Worst Performance Record

Tabulation VI—Analysis of 4-Kv Faults by Cause and by District

Tabulation VII—4-Kv Protective Device Operations

In 1956 our company began keeping punched card records of faults which caused forced outages on the transmission and distribution systems. This means of record-keeping permits utilization of sorters and accounting machines to produce many different summaries of the information contained in the cards. For the years 1956 and 1957, certain summaries were made of all faults, and from these summaries, Trouble Analysis Reports were prepared.

Preparation of the tabulations from the summaries of the fault cards formerly required approximately three man-weeks. Many of the quantities appearing in the tabulations could not be taken directly from the accounting machine summary tapes because further arithmetic was required to be performed on them, such as conversion to percentage and circuit-mile bases. Considerable cross-checking and references to several of the tapes were required to assemble each of the tabulations.

Complete Data Coded On Cards
Data to be punched on the cards

may originate from several sources. A service interruption may be reported by a customer or an employee. In either case, a troubleman is dispatched to the scene to correct the trouble. The troubleman sends in a report which includes the location of the trouble, the cause, the extent of the outage, the time at which service was restored, and other pertinent information. To this is added other information obtained from office maps and records. When all required information has been compiled, it is coded into numerical codes and punched on one or more cards. A typical data card is shown in Fig. 1. The more important items of information used in the program and their location on the card will be described briefly.

Column 5 contains a code number which represents the voltage class of the circuit on which the fault occurred, and columns 6-8 contain the last three digits of the circuit number. As there are not more than about 500 separate circuits in any voltage class in the Company's electrical system, three digits plus a voltage class code are sufficient to define any circuit. The voltage class and circuit number appearing on the card of Fig. 1 is 6022, which represents a 4-kv feeder, No. 4022.

Columns 27-29 contain the severity of the outage as measured by

the product of the kva interrupted and duration of the outage. For ease in handling and to reduce the number of card columns required for this item, the product is rounded off to the nearest hundred kva-hours. The digits punched in these columns of this card are 005, representing 500 kva-hours lost due to this fault.

Columns 30-33 contain a four-digit "cause of trouble" code. The first digit (Column 30) is a code number which defines the general class of trouble, such as equipment failure, accidents, or miscellaneous, and whether it occurred on an overhead or underground circuit. The second digit (Column 31) defines the type; e.g., if equipment failure, the type of equipment such as switching equipment and protective devices, conductor, transformer, etc. The third digit (Column 32) further defines the specific type of equipment or cause of the failure. The fourth digit (Column 33) contains a code number for weather as a contributing factor. The cause code appearing on the card of Fig. 1 is 4230. The first digit (4) represents an accident on an underground circuit; the second digit (2) represents a construction accident; the third digit (3) signifies that a customer's contractor was responsible; the last digit (0) signifies that weather was not a contributing factor.

Columns 35 and 36 contain a fault code number which describes whether or not the exact location of the fault was determined, and the effect of the fault on the system, such as entire circuit outage, momentary interruption, tap outage, etc. The number in Column 37 is related to the fault code number, and is a code number for overhead wires being down. For this card the fault code is 14, which represents a located fault resulting in the outage of a tap only. The zero in Column 37 signifies that no overhead wires were down.

Columns 51-80 contain information pertaining to the circuit, such as circuit-miles of overhead and underground conductor, connected kva, etc.

Not all data cards fed to the computer represent an actual fault. If there were no faults on a feeder during the year, a dummy card is

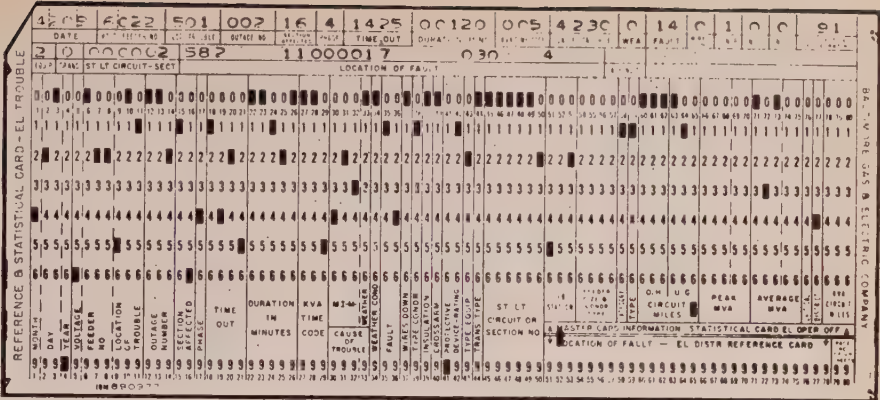


Fig. 1—Typical data card on which all required information regarding forced outages is punched by numerical codes.

inserted in the deck for that feeder.

Certain types of faults require more than one card to contain all the pertinent information. Suppose that following an outage of an entire feeder, service is restored in pieces, i.e., different portions of the load of the faulted feeder are picked up on adjacent feeders at different times. In order to have a complete record of this outage, a separate card is punched to indicate the times at which service was restored to each section. All of the information required for the tabulations of the Trouble Analysis Report will be contained on one card, the "fault card"; this is the only card pertaining to this outage which should be tallied in the various tabulations. The remaining cards pertaining to this outage are termed "trailer cards."

Other cards contain supplementary information which is tallied in one of the tabulations, but these cards are not processed by the main program which processes the fault card.

The criterion as to whether or not a card is a fault card is contained in the two-digit fault code.

Outline Of Program

The complete program, as initially written, required a total of approximately 3100 drum memory locations for instructions, constants, results storage, loading and punching sub-routines. This obviously exceeded the 2000-word memory capacity of the computer, requiring the program to be split into at least two phases. Because more output information was desired for 4-kv feeders, it was decided to arrange the program so that the first phase would process all data cards for 4-kv feeders, punch out tabulations which applied only to 4-kv feeders, and retain the totals for all 4-kv feeders in memory for later use. The second phase would then punch out the 4-kv portion of the remaining tabulations, process the cards for the other voltage classes, and punch out the tabulations for these voltage classes.

At the time this decision was made it was also felt advisable, in the interest of simpler and quicker program testing and "debugging," to punch out one of the 4-kv summaries in the skeleton form in

Fig. 2—Output card listing for a portion of Tabulation II of the annual Trouble Analysis Report.

2	6	1	1	67130	241	121	13	8	69	452
2	6	1	2		1410	705	78	44	400	2637
2	6	1	3		206	187	6	18	84	501
2	6	2	1	4684	43	469				512
2	6	2	2		625	6875				7500
2	6	2	3		93	319				412
2	6	3	1	71814						
2	6	3	2							
2	6	3	3							
2	6	4	1	71814	228	144	13	7	64	456
2	6	4	2		1325	832	73	40	371	2641
2	6	4	3		299	506	6	18	84	913

Voltage Classifi- cation	Circuit Miles	Basis for Analysis	Def. Sw. Equip. or Protect. Dev.	Condr., Cable or Splice Failure	Defective Trans.	Defective Reg. Equip.	Structural Equip.	Total Equip. Failure
4 Kv-O.H.	6,713.0	Faults/100 Ckt. Mi. % of O.H. Faults Kva Hours Lost	2.41 14.10% 20,600	1.21 7.05% 18,700	.13 .78% 600	.08 .44% 1,800	.69 4.00% 8,400	4.52 26.37% 50,100
4 Kv-U.G.	468.4	Faults/100 Ckt. Mi. % of U.G. Faults Kva Hours	.43 6.25% 9,300	4.69 68.75% 31,900				5.12 75.00% 41,200
4 Kv - Others	7,181.4	Faults/100 Ckt. Mi. % of Other Faults Kva Hours Lost						
4 Kv - Total	7,181.4	Faults/100 Ckt. Mi. % of Total Faults Kva Hours Lost	2.28 13.25% 29,900	1.44 8.32% 50,600	.13 .73% 600	.07 .40% 1,800	.64 3.71% 8,400	4.56 26.41% 91,300

Fig. 3—Portion of Tabulation II, which provides a detailed analysis of faults by cause.

which it was stored in memory. The skeleton form could then be re-loaded later with additional program steps to punch out this tabulation in desired form.

The complete program as finally written requires three separate program decks. The first, which uses about 1550 memory locations, processes data cards for all 4-kv feeders and punches feeder summaries for high-fault feeders (Tabulation IV), summary of 4-kv fuse and recloser operations (Tabulation VII), and skeleton district summary (Tabulation VI). The second requires nearly 1800 memory locations. The part of the program which processes the data cards is the same for all voltage classes, and is included in both decks. The remainder of the second deck is the program to punch the various summaries by voltage class (Tabulations I, II and III).

Because the information for these tabulations for the 4-kv voltage class is retained in memory it is not necessary to reprocess the 4-kv data cards. The third deck uses the skeleton district summaries punched out by the first deck as input data, and produces the completed district summaries (Tabulation VI) as output. This phase of the program uses about 500 memory locations.

A portion of one of the output tabulations, as it appears after list-

ing the output cards and after transcription for the finished report, is shown in Figs. 2 and 3, respectively. The only changes necessary in transcribing the output card list for the finished tabulation are the insertion of punctuation (decimal points, commas, percent signs, and zeros) and headings. This may be observed by comparing the two sets of numbers enclosed in the boxes on Figs. 2 and 3. It is recognized that the Type 407 accounting machine could be used to produce the tabulations in final form. However, the cost of wiring control panels for the Type 407 would far exceed the cost of manual transcription and typing.

Discussion Of Program Logic

The heart of the program is the portion which processes the data cards to tally each one in the proper location in each tabulation. Basically this is nothing more than a sorting and tabulating procedure. However, the manner in which the program accomplishes this on the IBM 650 is believed to be of particular interest. The development of the summary of faults by cause (Tabulation II) will be used for illustration. Similar logic is used in all other tabulations.

In order to make the most effective use of the computer memory, the tabulation is maintained in a skeleton form during the processing

of the data cards. When all data cards for a particular voltage class have been processed, another portion of the program performs the necessary arithmetic and rearrangement of the skeleton tabulation to produce the output cards in the desired form.

Table I shows the memory location assignments for a portion of this tabulation. The 10-digit capacity of each location is utilized to hold two items of information. The total number of faults is stored in the low-order digit positions and the total kva-hours lost is stored in the high-order digit positions. It may be noted that, for the portion of the table shown, each drum location corresponds to a unique combination of the first two digits of the cause code. Thus the memory location corresponding to any particular cause and category may be easily calculated by the computer itself.

The location of the first entry of this tabulation is 0514. Subtracting one gives a base number of 0513. To the base number various other numbers are added, depending on the various cause code digits. Zero or 15 is added to the base if the first digit is odd or even, respectively. To this quantity, a zero, a five, or an eight is added depending on whether the first digit is two or less, greater than two but less than five, or five or greater, respectively.

Finally, the second digit of the cause code is added.

For example, suppose that the card being processed is the card shown in Fig. 1. The first two digits of the cause code are 4 and 2, respectively, representing an underground fault caused by a construction accident. A 15 must be added to the base number because the first digit is even; a 5 must be added because the first digit is greater than two but less than five; and finally, a 2 must be added because that is the second digit of the cause code.

The location in which this fault is to be tallied is thus computed to be $0513 + 15 + 5 + 2 = 0535$. The computer then places the contents of location 0535 in its arithmetic register, adds one to the count or tally in the low-order digit positions, adds the kva-hours lost due to this fault in the high-order digit positions, and then returns the new totals to the same location in memory, namely 0535.

Certain other locations in the table cannot be determined in this manner because of the cause code

structure for certain types of fault. Only the first two digits of the cause code are used for most faults, but some require the use of three or four digits for determination of the storage location corresponding to the cause. The computer handles these by first examining the cause code of each data card to see whether or not it is one of these exceptions. The exceptions are then processed by a different part of the program and all others are treated in the manner described in the preceding paragraphs.

Use of this method of sorting and tabulating faults due to each cause leads to waste of a few memory locations, as indicated by the dashes shown in Table I. For example, location 0532 will never be used because line regulators and capacitors are not installed on underground feeders of the Company and hence cannot be a cause of trouble. However, if it had been attempted to utilize these locations, this simple method for computing locations from the cause code digits could not have been used as exten-

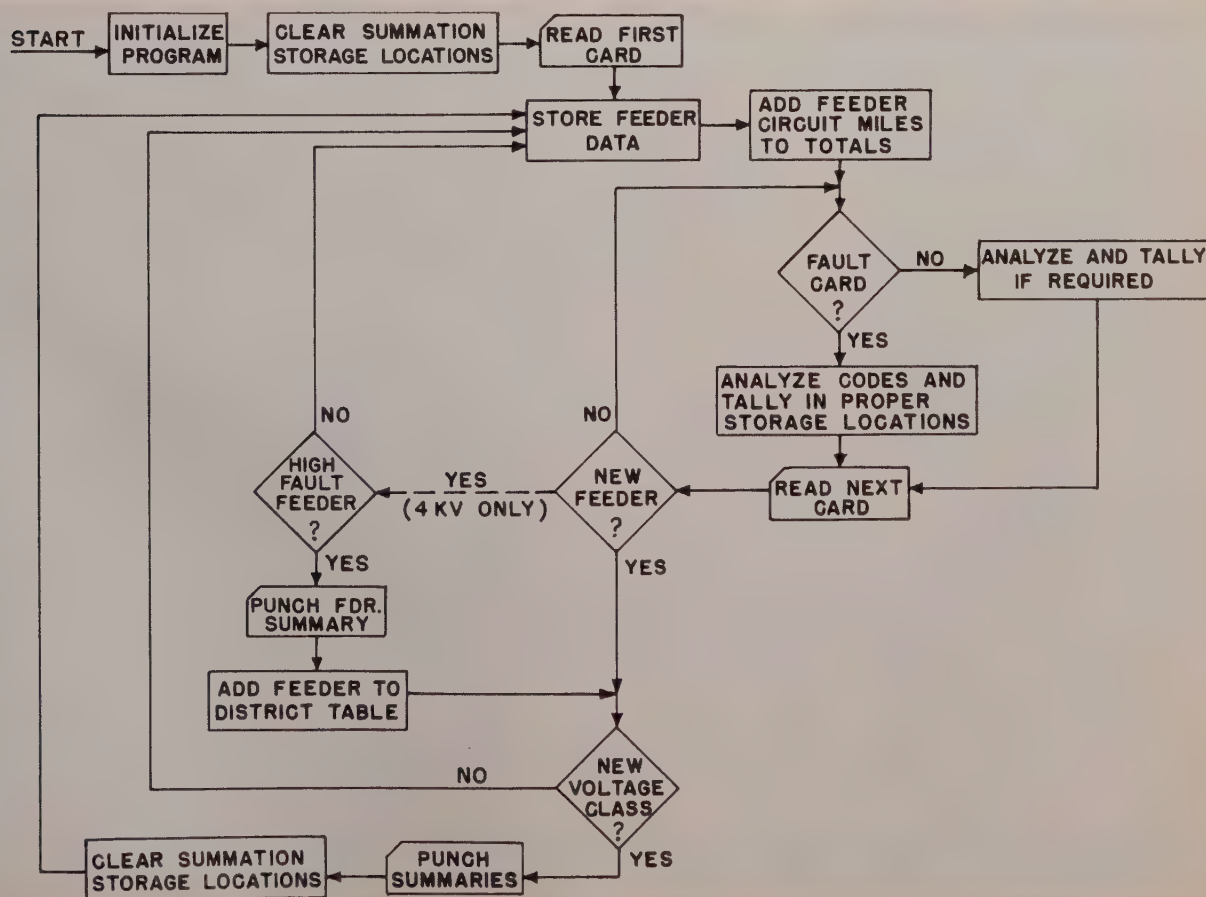
sively, and the program would have been more complicated.

Program Fits Existing Cards

It is important to remember that the program was written to utilize the existing fault cards, with existing card layout and existing codes. The Trouble Analysis Report is not the only use which is made of these cards. If a fresh start had been made to design a separate card system and code structure for use in assembling this Report only, undoubtedly the program could have been much simpler. However, the cost of assembling the tabulations on the computer with this program is so low, such a step cannot be justified, particularly in view of the other uses which are made of the fault cards.

Because a variable number of digits of the cause code are used, it was believed that the programming technique described would result in fewer computer instructions, more effective use of the computer memory, and shorter operating time than would a tech-

Fig. 4—Complete, but greatly simplified, flow diagram of the entire computer program.



nique utilizing the automatic table lookup feature of the Type 650. Every effort was made to keep operating time to a minimum. A measure of the success of this effort is the fact that practically any data card is completely processed within the 270 milliseconds of the read cycle available for computing.

A complete, but greatly simplified, flow diagram of the entire program is shown in Fig. 4. Starting in the upper left-hand corner of this diagram, the first block contains instructions which set up certain instructions and constants in other parts of the program for the first voltage class. The next block prepares the memory locations reserved for the various skeleton tabulations to start accumulating the tallies by resetting the contents of these locations to zeros. The first data cards is then read into the computer. The data pertaining to the feeder on which this fault occurred, such as feeder number, circuit miles, etc., are transferred to temporary storage locations. The next block adds the circuit miles of this feeder to the total circuit miles.

The next step in the program is a branch point. The two-digit fault code is examined by the computer to "decide" whether or not the card being processed is a fault card. If it is a fault card, the program continues to the next block immediately below, which is the main program for tallying the fault in all the proper locations of the various tabulations. A part of this block was described previously. If it is not a fault card, the flow is to the block on the right. This block further analyzes the fault code, tallies a supplementary card where required, bypasses a dummy or trailer card, and then rejoins the main program at the next step.

The next data card is now read into the computer. If the feeder number on this card is the same as for the preceding card, the program returns to the first branch point and the cycle is repeated.

If this card is for a different feeder, then the voltage class code is analyzed for a new voltage class. If it is not a new voltage class, then the program returns to the "store feeder data" block. If it is a new voltage class, the program enters

the routines for punching out the tabulations, proceeds to the left in the diagram to reset the skeleton tabulations to zero for the next voltage class, and finally returns to the "store feeder data" block.

At the "new feeder" branch point, note that there is a dotted flow line to the left for 4-kv feeders only. During the first phase of the program, which is for 4-kv only, the flow is in this direction when a new feeder number is encountered.

Economic Comparison

The cost of preparing the tabulations from accounting-machine summary tapes by the method formerly used is estimated to have been about \$500. The cost of producing the tabulations for 1958 on the Type 650 computer was about \$100. Computer rental cost for processing approximately 5000 data cards and punching the tabulations was \$65. The balance includes estimated costs for various items, such as annual charges for wiring control panels for the Type 650 computer and Type 407 accounting machine, charges for listing output cards, and charges for additional data-card handling necessary to eliminate erroneous cards.

All costs which are not affected by the method used to produce the tabulations have been eliminated from these comparisons. Therefore, use of the computer in place of the former method results in a net annual saving of about \$400. The cost of developing the computer program, including programming cost and computer rental for program testing, is estimated to have been about \$1100. Thus the annual return on the investment is about 36 percent.

In addition to the cost reduction there is a very considerable reduction in time required to produce the tabulations. The former method required three man-weeks, which usually meant four or more calendar weeks. The time required to produce the 1958 tabulations was 48 minutes computer time, plus an additional half-hour to sort and list the output cards.

Conclusion

The automatic assembly of the tabulations of the Trouble Analysis Report by means of the IBM Type 650 computer results in appreciable savings in both cost and time. These savings have amply justified the program development cost.

Table I

Memory Location Assignments for Portion of Cause Summary Tabulation

First Digit of Cause Code	Second Digit of Cause Code	Cause	Memory Overhead Faults	Location Underground Faults
1,2	1	Defective switching equip. and protective devices	0514	0529
	2	Conductor, cable, or splice failure	0515	0530
	3	Defective transformer	0516	0531
	4	Defective line regulators and capacitors	0517	--
	5	Defective structural equip.	0518	0533
3,4	1	Vehicular accidents	0519	0534
	2	Construction accidents	0520	0535
	3	Tree trimming accidents	0521	--
5,6	1	Trees	0522	--
	2	Lack of maintenance	0523	0538
	3	Others	0524	0539

NOTE: First digit of cause code is odd for overhead faults and even for underground faults.



Fig. 1 — Completed 230-kv H-frame structure equipped with crossarm of spiral-welded steel tubing with 13 $\frac{3}{8}$ -inch outside diameter and 12-gauge wall thickness.

UNIQUENESS marks PGE's newly-constructed 230-kv line from its Bethel Substation east of Salem to the Chemawa-Santiam BPA tie. This is because of its tubular metal crossarms, believed to be the first used in conjunction with H-frame wood-pole structures.

Three types of metal crossarms have been installed on the 3.66 miles of the new line, as follows:

- (a) Spiral-welded steel tubing with 13 $\frac{3}{8}$ -inch outside diameter and 12-gauge wall thickness.
- (b) Longitudinal welded steel tubing with 10-inch outside diameter and $\frac{3}{16}$ -inch wall thickness.
- (c) Extruded aluminum tubing with 9 $\frac{1}{2}$ -inch outside diameter and $\frac{1}{4}$ -inch wall thickness.

All three types of metal crossarms are supported on the poles in essentially the same manner. Fig. 2 shows the detail used for the aluminum arm. Both the 10-in.-diameter steel arm and the aluminum arm are equipped with $\frac{3}{4}$ -in. eye bolts for insulator attachments as shown in Fig. 3. The 13 $\frac{3}{8}$ -in.-diameter steel arm has a plate and eye

A 230-KV INNOVATION— METAL CROSSARMS ON H-FRAME LINE

By **LESLIE E. HODEL**

Asst. Chief of Structural Branch

Engineering Department

Portland General Electric Company

So far as is known, PGE's new 230-kv H-frame line incorporating tubular metal crossarms is a first for the industry.

welded at the end of the arm for this purpose. All three arms are closed at the ends.

Basis For Design Of Structure

Design is for heavy loading ($\frac{1}{2}$ inch of ice, 4-pound wind plus the constant) with a maximum design tension of 8000 pounds. Conductor is 795-mcm ACSR 26/7 stranding. Insulation is the same as was previously used on a wood-spar arm, 12-15,000 pound units in suspension and 14-25,000 pound units in strain. Span lengths vary from 373 to 800 feet with a maximum ruling span of 725 feet. Two $\frac{3}{8}$ -inch, 7-strand utility-grade steel static wires are carried on the pole tops for the first mile out of the substation.

Maximum loads are shown in Fig. 4. It should be emphasized that these are ultimate loads for design purposes and that the arms are expected to withstand only these loads

at their yield points. It should also be noted that the loading conditions do not provide for broken conductor loads.

This loading allows, with a two-to-one factor of safety and 795-mcm ACSR 26/7 conductor, for an 835-ft span, the weight of insulation, hardware and a lineman plus a line angle of 3 degrees, all with heavy loading and 8000-lb tension. With 1272-mcm all-aluminum conductor, 8500-lb conductor tension, and all other conditions the same, the allowable span would be 750 feet. The detail of the arms is such that double arming is convenient so that longer spans than these may be accommodated.

Design results were positive and served to re-emphasize the basic adaptability of the hollow circular cross-section to loading conditions about more than one major axis. The uniformity of the cross-section

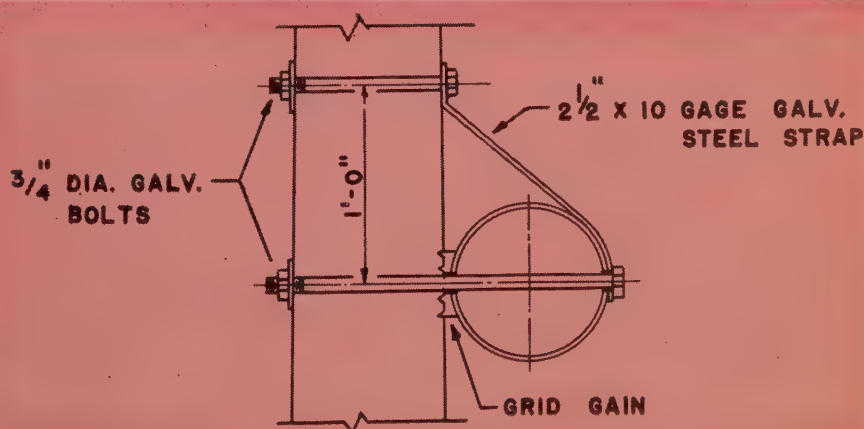


Fig. 2—Detail of the support used for the aluminum crossarm.

Fig. 5—Line-construction crew preparing to lift spiral-welded tubular steel crossarm.

permits vector addition of stresses; this in turn results directly in fewer pounds of metal to perform the function of resisting the loads imposed upon the member. As an example, an arm composed of two 8-inch 11.5-lb structural steel channels with lace bars weighed 1000 pounds; a ten-in.-diameter by $\frac{3}{16}$ -inch wall pipe arm will perform the same job and weigh 840 pounds. If all other things are equal then pounds of metal can be translated into cost in approximately direct proportion.

All Arms Withstood Load Test

The arms were tested to the loads shown in Fig. 4. They all successfully withstood this loading and two of them, the 10-in.-diameter steel and the aluminum arm, had not yet failed at approximately 20 percent more than these loads. At this point tests were halted because of safety consideration. Deflections were recorded for all tests and were naturally greatest in the aluminum arm. At maximum *design* loads of one half the values shown in Fig. 4, vertical deflection was approximately 5 inches. Deflection, as such, is not considered to be important in this application.

Previous H-Frame Experience

The Company's use of the H-frame wood structure for 230 kv dates back only to 1956 when some 8 miles of line was constructed using a structure identical to that shown in Fig. 4 except that a turned wood-spar arm 13 inches in diameter and of uniform cross-section



was employed. This line has had but three years of service to date and has been entirely satisfactory.

In the fall of 1957, however, disturbing reports about decay of treated timber (Douglas Fir) spar arms began to circulate within the utility industry in this area. One investigator reported a sample with 30% of the arms he inspected showing "serious" interior decay. Maximum length of service of arms in this sample was eight years. (The cause of this high decay rate has been attributed to checking after treatment allowing water to penetrate past the zone of treatment

into the untreated interior of the arm. It is thought that since the arm is in a horizontal position this moisture does not drain and decay of the interior ensues. It is not the purpose of this article to discuss this problem at length. Several theories have been advanced as to the basic cause of the problem and various solutions for it have been proposed. It is, however, still considered by many as unsolved.)

Alternate Designs Studied

Under this impetus, development of a replacement for the wood spar arm was begun. A variety of designs was investigated. Included were sawed timber arms of rectangular cross-section, laminated timber arms of rectangular tapered section, structural steel arms including the laced channels back to back and truss-types used by other utilities, small-diameter pipe arms with tension rods and even an extruded aluminum arm of elliptical cross-section. These alternates were carefully designed and costs were

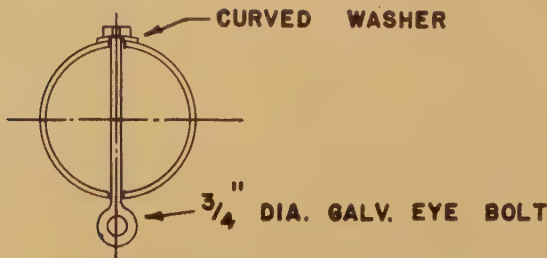


Fig. 3—Both the 10-in.-diameter steel crossarm and the aluminum crossarm are equipped with insulator attachments of this design.

Fig. 4—Sketch showing ultimate design loads for new H-frame structures with tubular metal crossarms.

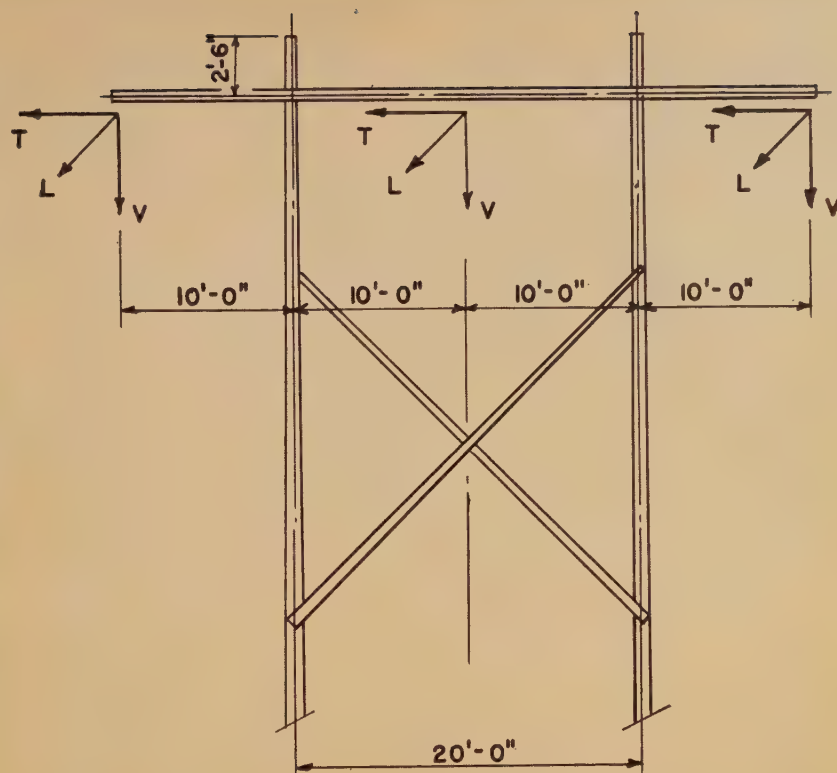
estimated as accurately as possible. Costs, of course, are an extremely important consideration in any selection of alternate courses of action. The tubular metal crossarms were compared with the wood spar which they replaced, with the other types of arms studied and with each other on both a first cost and life cost basis. Present-worth methods were used to evaluate maintenance and replacement charges. These studies were purposely conducted in a conservative manner so that errors in predictions of the future would weight the results in favor of the items with lowest first cost. Results were conclusive. The tubular arm was clearly more economical than all others on a life cost basis; in first cost it was only slightly more expensive (less than 10%) than the wood spar with comparable hardware.

No Major Installation Problems

The new line was built by crews of the Willamette Valley Division of the Company. No major problems were encountered in either the handling or erection of the arms. The 10-in.-diameter arm was galvanized and as a consequence had to be split at the mid-point to be accommodated by the available galvanizing facilities. This necessitated field-bolting of center flanges and required an appreciable amount of assembly time. The 13 $\frac{3}{8}$ -in.-diameter arm was painted and some extra caution was observed in handling to prevent damage to the coating. The aluminum arm was easiest to handle (it weighed 350 pounds) and did not require assembly or extra care in handling.

The 10-inch-diameter arm was furnished and tested by the Beall Pipe and Tank Corporation of Portland, Oregon. The 13 $\frac{3}{8}$ -inch-diameter arm was furnished and tested by the American Pipe and Construction Company of Portland, Oregon. The Aluminum Company of America furnished and tested the aluminum arm.

Operational experience with this unique design of 230-kv H-frame structures has been entirely satisfactory since the line went into service on October 13, 1959.



V = 4300 LBS

T = 2000 LBS

L = 700 LBS

WOOD POLE TANGENT STRUCTURE

Fig. 6—Mounting bolts being installed on tubular steel crossarm by line-construction crew.



PAINTING TRANSFORMERS IN PLACE CUTS COSTS 40%

By T. H. HALL
Division Superintendent,
Carolina Power & Light Company



Finish coat being applied to energized 25-kva transformer on Atlantic Beach near Morehead City, N. C.

Carolina Power & Light Co. has inspected and painted over 1100 transformers in place for less than 60% of the cost of taking them to the shop for painting. In fact, the cost of merely replacing the transformers is almost 30% more than the complete inplace job. Method provides the opportunity to inspect everything on the pole and do other needed maintenance. Public reacts favorably to clean, bright tanks which replaced the dark rusty ones.

NO ONE ever considers hauling large substation transformers off to the shop just for painting. It is easier and more economical to paint them in place. For two years Carolina Power & Light Co. has been trying to prove that, under the proper conditions, the same can be true of distribution transformers on poles.

Conditions

The conditions necessary to make this true are:

1. Rapid deterioration of tanks and mounting hardware, because of highly corrosive atmosphere, if transformers are not kept painted.
2. A large number of transformers to be painted in the same area.
3. Most of the transformers can be de-energized for painting.
4. Suitable equipment available.
5. Use of a small crew (two men).
6. Skilled and conscientious workmanship in preparing surface and applying paint.
7. Choice of reasonably long life, easy to apply paint.
8. Advantage taken of opportunity to do other maintenance.

Corrosive Atmosphere

Most of the territory in which this test is underway is along Onslow Bay, which is formed by the curve of the North Carolina coast

between Cape Fear and Cape Lookout. The coast line runs almost North-South near Cape Fear, and East-West under Cape Lookout. The prevailing wind is Southeast. This subjects everything in the area to a constant salt-laden dampness. Most storm winds are Northeast. These storms also bring salt out of sounds and inlets, with a sand-blasting effect as well.

In this sort of environment corrosion flourishes. Neglected transformers have been found hanging by their leads or dripping oil from rust holes in the tanks. Obviously these transformers should have

Finish coat being applied to de-energized 5-kva transformer on Atlantic Beach near Morehead City, N. C.



been replaced. But at what stage of deterioration?

Replacing Transformers

It costs money to put up and take down transformers; also to thoroughly inspect them frequently. Do we get all the good out of the old paint job and risk losing the entire transformer, or do we change it before it is necessary? If we do put up a freshly painted one, the paint will be scarred, to some extent at least, in handling, thereby losing some of its life. The old transformer will be taken to the shop and repainted at further expense. This is one condition for profitable in-place painting.

Density

The second condition is density. There are over 1,800 transformers within ¼-mile of salt water in the area under consideration. Most of these are in thickly populated summer resorts. This is important, since each transformer must be visited twice, and moving time is kept to a minimum.

Transformers De-Energized

If the transformer can be de-energized, considerable time can be saved. Leads do not have to be covered and there is more freedom of movement. This offers no problem in a resort in the "off"-season. The

past two winters, however, have been unusually cold and rainy. No painting was done at temperatures below 40 F, on the paint manufacturer's recommendation, and dry weather was, of course, necessary. This shortened the "off"-season painting period. There has been very little difficulty in arranging interruptions in residential areas, even in the summer, so long as cooking hours are avoided.

Equipment

One of the inspirations for this program was a piece of equipment owned by one of our contractors. It is one of several somewhat similar machines consisting of an insulated bucket on the end of an articulated boom, mounted on a truck. It can be operated from the bucket and can reach under, over, and around transformers with ease. Another of our contractors has devised a platform to mount on the A-frame of a line truck. The platform is on a swivel and can be locked in any position by means of an hydraulic brake. With either of these rigs, two men can do the job.

Skilled Crews

Much of the success of the program has been due to the personnel assigned to this work by the above firms. The crews have shown genuine interest in the work and have done an excellent job with a minimum of supervision.

Paints Chosen

The paints used were chosen on the carefully considered recommendations of a manufacturer whose products we have used for many years. Two coats are applied. A light color was chosen for the finish, as it would not be subject to fading, and also would allow the darker primer to show through to indicate when the time comes for repainting or touch-up. The paint selected was chosen for its rust-inhibition plus its resistance to salt and ease of applying. It is pigmented with suboxide of lead and its vehicle is composed of good penetrating linseed oil reinforced with epoxy ester resin. Other paints such as the catalyzed epoxies, would probably be more durable but were considered impractical for this application. The manufacturer also recom-

mended the procedure for preparing the surface, and its representative directed a complete practice job on a transformer mounted on a post before the first crew attempted one in service.

Other Maintenance

The last condition listed is a tremendously valuable by-product of the program. Everything on the pole is inspected. When the transformer can be de-energized, all current-carrying connections which show any evidence of corrosion, looseness or heating, are disconnected, cleaned, treated with a corrosion inhibitor, and replaced. Cut-outs are cleaned up or replaced if necessary. Fuses are replaced unless it is obvious that the proper fuse has been recently installed. There are two reasons for this. The fine strands in the flexible tails corrode, often causing heating and faulty operation, and improper fuse sizes are often found following a major storm. There is no way of estimating how much trouble and expense this maintenance work has saved.

Favorable Reaction

Another benefit, which cannot be counted in dollars, is the favorable reaction of the public to the clean, bright tanks which replaced the dark rusty ones.

First Year's Results

The painting program got under way in April 1958 and continued through the summer and into the fall. The fall and winter gave the paint a really severe test. Hurricane Helene brought the highest winds

Painting 37½-kva transformer on 4-kv Y line at Wrightsville Beach, N. C. Photo courtesy of Subox, Inc.



Painting bottom of 15-kva transformer on 4-kv Y line at Wrightsville Beach, N. C. Photo courtesy of Subox, Inc.

ever recorded in this area—135 mph at Wilmington. Later on ice and snow came in considerable amounts, which is unusual in this vicinity. Inspection in the spring showed the majority of transformers looking as though they had just been painted. A few had scars on the paint, probably due to flying debris during the hurricane. Approximately 30% showed a slight amount of brown discoloration, usually on the bottom of the tank. This was from traces of rust that had not been completely removed before painting. These spots were cleaned and repainted.

Procedure

Upon arriving at the location, the crew makes a quick inspection of the transformer. If the corrosion is too far advanced to make painting practical, a note is made and they move on to the next one. A work order will be made to replace the transformer.

If the transformer is found suitable for painting, the pole is examined carefully. There is not much point in painting a transformer that will soon have to come down for pole replacement. If the pole is bad, it is noted and no more time is spent there.

Customers Notified

Before a transformer is de-energized, the customers are notified. The primary riser is disconnected.

(Continued on page 101)

CHART SIMPLIFIES SAG COMPUTATIONS

By A. C. Gohlke
Principal Consulting Engineer,
The Cleveland Electric Illuminating Company

THE FOLLOWING METHOD of computing sags for transmission lines is simple and adaptable to computation on the slide rule. Although a cubic equation is involved in the computation, its solution is simplified by use of a chart.

The Cubic Equation

It will be shown that the equation, $X^3 = aX + K$ represents span characteristics at a given temperature and loading where,

X = sag, expressed as a percentage of span,
 a = thermal factor, and
 K = elastic factor.

Thermal factor a is affected when the conductor undergoes a temperature change and elastic factor K is affected when the conductor undergoes a mechanical loading change. The manner in which sag X varies with respect to changes in a and K is the objective of this method of sag computation.

The small amount by which conductor length exceeds distance between its supports in a span L with sag S can be approximated as $\frac{8S^2}{3L}$ which, on a unit-length basis becomes $\frac{8}{3} \left(\frac{S}{L}\right)^2$ by dividing through by L .

Since thermal and elastic characteristics of the conductor material contribute appreciably to this excess, their contributions can be related as follows:

$$\frac{8}{3} \left(\frac{S}{L}\right)^2 = c + at + \frac{T}{M} = c + at + \frac{wL}{8MA} \left(\frac{L}{S}\right) \quad (1)$$

where,

a = thermal coefficient of expansion (per degree F),

M = modulus of elasticity (lbs per sq in.),

t = temperature of conductor (degrees F),

T = stress in conductor = $\frac{wL}{8A} \left(\frac{L}{S}\right)$ (lbs per sq in.),

w = conductor weight per foot in pounds,

A = cross section area of conductor (sq in.), and

c = balance of conductor material required to satisfy equation.

Adaptation of transmission-line sag equations so that a single chart can represent span characteristics provides a simple method for computing sags.

If for $\left(\frac{S}{L}\right)$ we substitute $\left(\frac{X}{100}\right)$ where X equals sag in percent of span, then equation (1) becomes,

$$\frac{8}{3} \left(\frac{X}{100}\right)^2 = c + at + \left(\frac{wL}{8MA}\right) \left(\frac{100}{X}\right).$$

Collecting numerical coefficients and rearranging,

$$\left(\frac{2.667}{100}\right) X^2 = c + at + \left(\frac{wL}{XMA}\right) (12.5).$$

Multiplying through by X and solving for X^3 ,

$$X^3 = \left(\frac{100}{2.667}\right) (c + at) X + \left(\frac{wL}{MA}\right) \left(\frac{100}{2.667}\right) (12.5),$$

Simplifying,

$$X^3 = 3750 (c + at) X + 46,875 \left(\frac{wL}{MA}\right), \quad (2)$$

resulting in an equation of the form,

$$X^3 = aX + K$$

where

$$a = 3750 (c + at), \text{ and}$$

$$K = 46,875 \left(\frac{wL}{MA}\right).$$

It will be noted that a changes with temperature by an amount equal to $3750 a (t - t_0)$ and that K changes directly with conductor loading or by the ratio of $\frac{w}{w_0}$.

An allowance for creep should be made with some conductor materials at the time of stringing operations so that final sags will be correct after set takes place. This can be accomplished with this method by selecting a sag value for a temperature which is δ/a degrees below ambient where δ is the per-unit length creep expected of the conductor material.

Derivation of Computation Procedure

The following data is essential for all methods of sag computation:

M = modulus of elasticity of conductor material in lb per sq in.

a = thermal coefficient of conductor material per degree F

A = cross-section area of conductor in sq in.

w = unloaded weight per ft of conductor in lb

w_0 = loaded weight per foot of conductor in lb

t = temperature of conductor at loading w

t_0 = temperature of conductor at loading w_0

*The tensions refer to conductor tensions at the low point of the span. They are less than the support tensions by an amount equal to the weight of "S" feet of conductor.

P_0 = conductor tension* at loading w_0 and temperature t_0 in lb.

Determination of X_0 , K_0 , and a_0 under tension P_0 at temperature t_0 and loading w_0 .

$$X_0 = \frac{12.5w_0L}{P_0},$$

$$K_0 = \frac{3750 P_0 X_0}{MA}, \text{ or } \frac{46,875 w_0 L}{MA},$$

$$\text{and } a_0 = X_0^2 - \frac{K_0}{X_0}.$$

Determination of a , k , and X under temperature t and loading w .

$$a = a_0 + 3750 a (t - t_0)$$

$$K = \frac{w}{w_0} K_0$$

$$\text{and } X = [\text{select from Chart Fig. 1}]_K^a$$

Since X represents sag as percentage of span length, actual sags and tensions can be determined readily by the formulae,

$$S = \frac{XL}{100}$$

$$\text{and } P = \frac{12.5wL}{X}$$

Example

What will be the sag and tension at 60F of a No. 4/0 HD bare copper conductor in a 700-ft span which when loaded to 1.645 lb per ft at 0F has a tension of 4500 lb? The following data applies:

$$L = 700 \text{ ft}$$

$$M = 15 \times 10^6 \text{ lb per sq in.}$$

$$a = 9.6 \times 10^{-6} \text{ per degree F}$$

$$A = 0.1662 \text{ sq in.}$$

$$w_0 = 1.645 \text{ lb per ft}$$

$$w = 0.653 \text{ lb per ft}$$

$$P_0 = 4500 \text{ lb}$$

$$t_0 = 0\text{F}$$

$$t = 60\text{F}$$

$$X_0 = \frac{12.5 w_0 L}{P_0} = \frac{(12.5) (1.645) (700)}{4500} = 3.2$$

$$K_0 = \frac{3750 P_0 X_0}{MA} = \frac{(3750) (4500) (3.2)}{(15 \times 10^6) (0.1662)} = 21.6$$

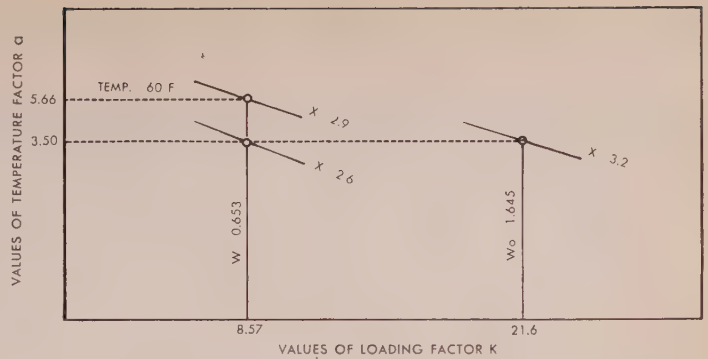


Fig. 2—Values of temperature and loading factors for the example given in the text are here entered in this abbreviated version of the chart of Fig. 1 to show how values of X are determined. This chart also shows relationships as temperatures or loadings are varied.

$$a_0 = X_0^2 - \frac{K_0}{X_0} = (3.2)^2 - \frac{21.6}{3.2} = 3.50$$

$$K = \left(\frac{w}{w_0}\right) K_0 = \left(\frac{0.653}{1.645}\right) (21.6) = 8.57$$

$$a = a_0 + 3750 a (t - t_0) = 3.50 + (3750) (9.6 \times 10^{-6}) (60) = 3.50 + 2.16 = 5.66$$

Values of thermal constant a and of loading factor K have now been found for conditions assumed at both zero F with heavy loading and at 60F with bare conductor only. Fig. 2 highlights how constants X are found using an abbreviated form of the chart. X is found to be 3.2 under conditions of zero F and of heavy loading which checks with data given. At 60F with bare conductor only, X equals 2.9. Other values of X for other conditions are found similarly.

Returning to conditions at 60F,

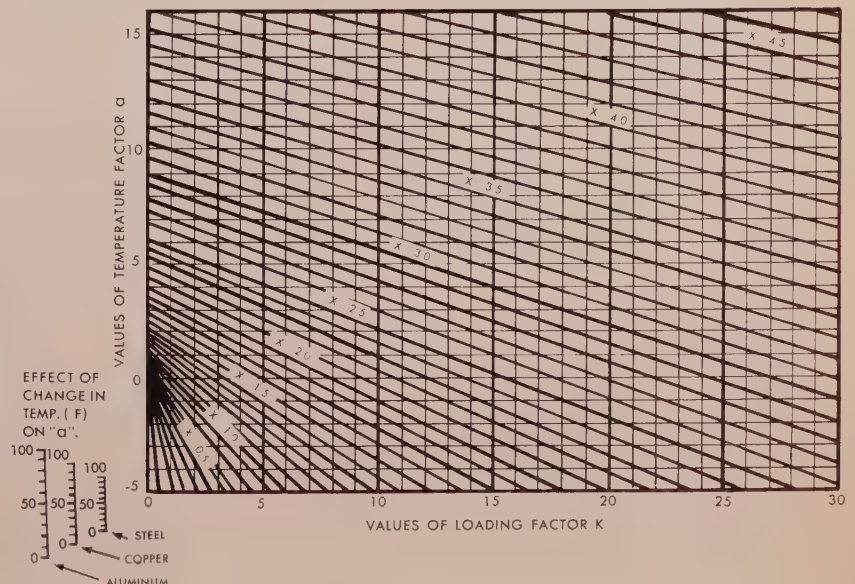
$$X = \left[\text{Fig. 2} \right]_{K=8.57}^{a=5.66} = 2.9$$

$$\text{Sag} = S = \frac{XL}{100} = \frac{(2.9) (700)}{100} = 20.3 \text{ ft}$$

$$\text{Tension} = P = \frac{12.5 w L}{X} =$$

$$\frac{(12.5) (0.653) (700)}{2.9} = 1970 \text{ lb.}$$

Fig. 1—Sag relationships of a transmission conductor can be expressed in the form of the cubic equation, $X^3 = aX + K$ where a is a factor introducing effects of temperature variations and K relates conductor loadings and elasticity with sag. Solutions of this cubic equation for various values of a and K are given in this chart, simplifying sag calculations.



ARE WE GROUNDING FOR LEAST POSSIBLE HAZARDS?

On tower or in substation, it is safer to ground at the work area, and to ground all three conductors.

By H. L. RORDEN,
High Voltage Practices Engineer
American Electric Power Service Corporation

BEST OVERALL back-up protection for both linemen and groundmen working on and around a "dead" transmission line is provided by grounding all three conductors at the work area.

It has been more or less common practice in this country to place grounds on both sides of a work area, usually on adjacent structures on transmission lines, or on both sides of station equipment. The intent was to provide workmen with a neutral area, and the practice was regarded as adequate.

However, working between grounds, and grounding only the conductor worked upon do not always assure safety, particularly on lines not equipped with ground wires. Ground wires reduce the hazard, but basically the hazard principle is the same.

Consider a case where a conductor being worked upon is grounded at towers on both sides of the work area, but not on the tower at the work area. (See Fig. 1.)

If the line should become energized, the adjacent towers would carry fault current to ground. Because of their footing resistance, those towers and also the "grounded" conductor would be at a dangerous voltage from true ground. Since the conductor on the intermediate tower—where work is to be done—is not connected to the

tower, this tower will not carry fault current. Consequently, the intermediate tower will be at true ground potential while the conductor will not be.

Hence, a dangerous voltage can exist between "grounded" conductor and tower, right where men are working, despite grounds on both sides of the work area.

The unsafe condition is shown schematically in Fig. 2 for one side of the work area, and can be analyzed by Ohm's Law. Merely trace the circuit from the "grounded" conductor at the tower adjacent to the work area, to find what could be a lethal voltage there. Magnitude

of working-area voltage depends on footing resistance of the adjacent towers and their distance from the supply substation. Should this resistance be relatively low, fault current will be high; if footing resistance is high, fault current will be lower.

In either case, voltage that can exist between "protected" conductor and tower may be almost as high as system voltage. If a tower footing has a resistance of two ohms, and fault current is 2500 amps in the tower, a long distance from the supply point, there will be nearly 5000 v between conductor and tower—right where linemen are

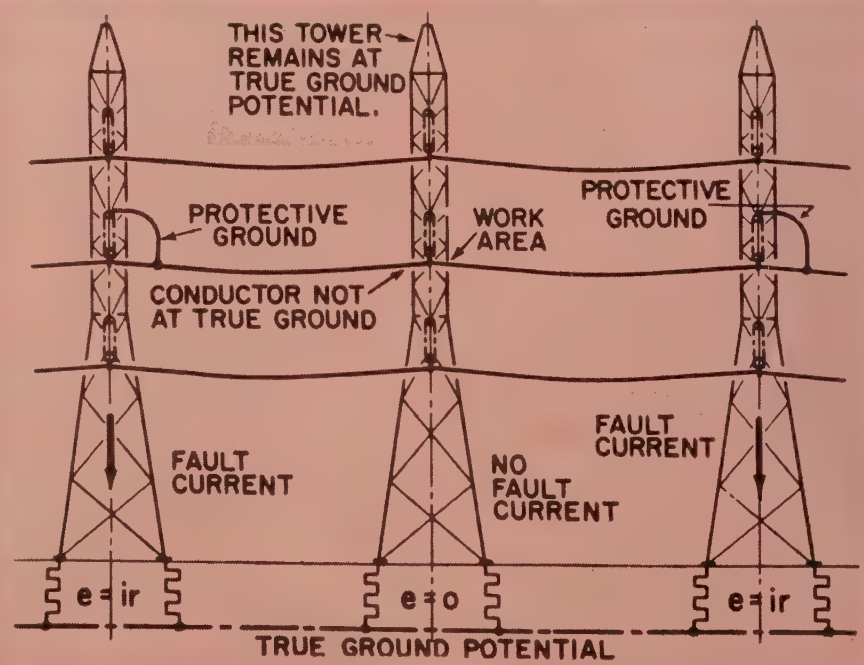


Fig. 1—When conductor at work area is not connected to tower, it can be at different potential than tower during fault current conditions.

working. Near the supply point there could be 5000 or 10,000 amps on the same line, and the potential in the working area could be 10,000 to 20,000 volts!

If a conductor and tower are insulated from each other, one can never be really sure whether or not there may be voltage between them. For a lineman on a tower or ladder touching a conductor, it is essential that there can be no voltage between his hands and feet. The surest place to find zero voltage is right where conductor is connected to tower.

Omit Adjacent Grounds, But:

Grounds on adjacent towers will not provide added assurance, so they may as well be omitted. However, this protection for linemen can subject groundmen to possible voltages that can be dangerous near towers unless all three conductors are tower grounded.

If only the conductor upon which work is being performed is tower grounded, the tower will carry fault current. This can be minimized by tower grounding all three conductors to balance neutral current. Then when all conductors are faulted, they will carry equal current, and there will be no ground current through the tower footings.

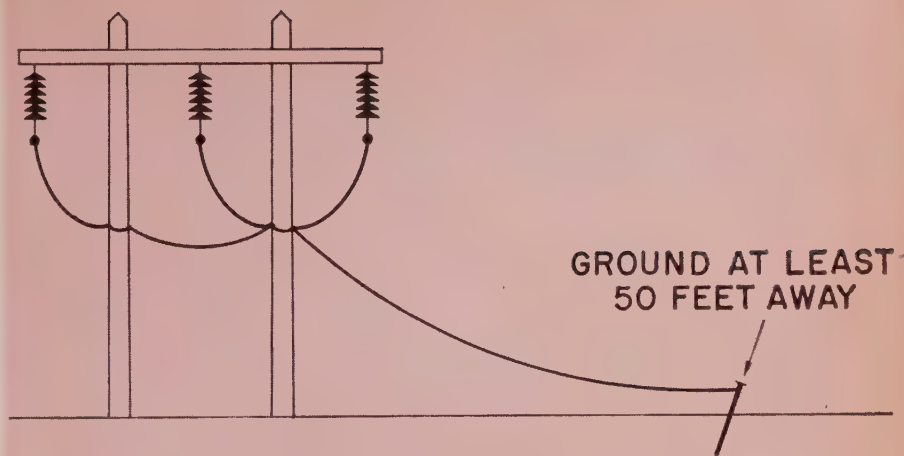


Fig. 2—Three-phase grounding advantages can be gained on H-frames, too.

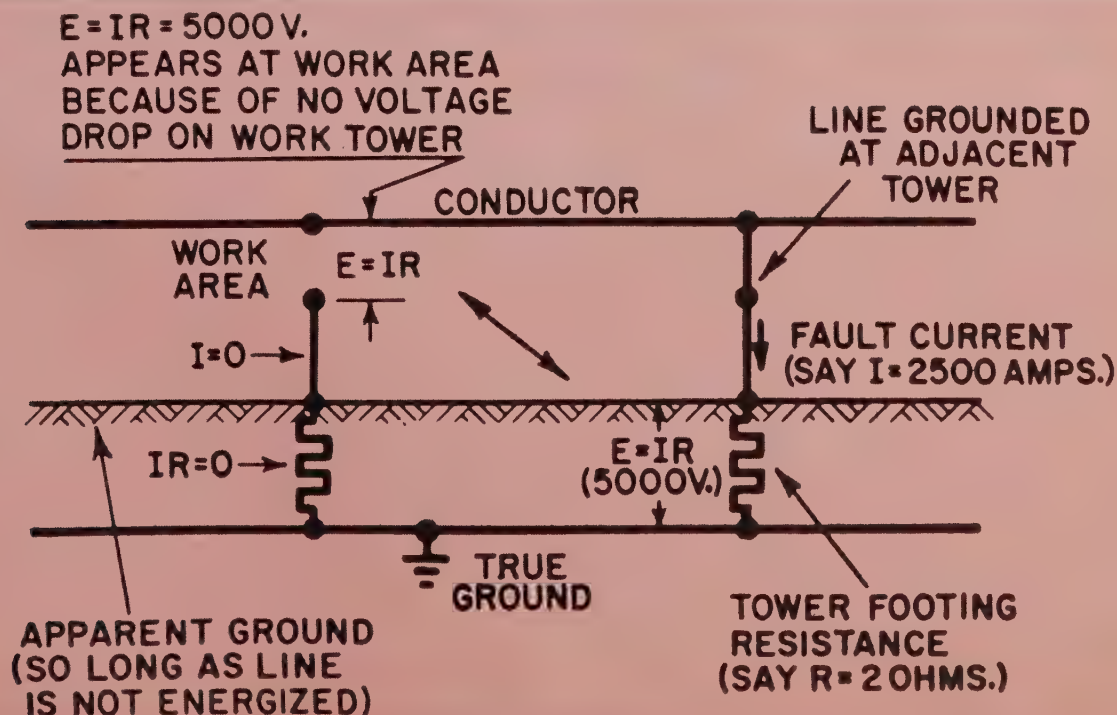
Another caution must be observed for maximum protection: Ground current will flow during a period of unbalance while a breaker is closing at the supply point, and so, close adjustment for nearly simultaneous closing of all poles is essential. High-speed clearing of faults also greatly reduces the hazard.

Works On Wood Structures, Too

On wood-pole lines, where the structure does not have a ground,

a preferred method is to attach a metal pole band having a cluster block 10-20 ft below the conductors and to attach portable grounds from all three conductors to this band. On H-frame structures, a band should be placed on both poles as in Fig. 3, thus creating an effective neutral grounded area for the linemen above the pole bands. A conductor from one of the bands should be grounded to guy anchors or to improvised grounds.

Fig. 3—Note that true ground differs from tower ground when fault current is flowing. Potentials are built up across tower-footing resistance.



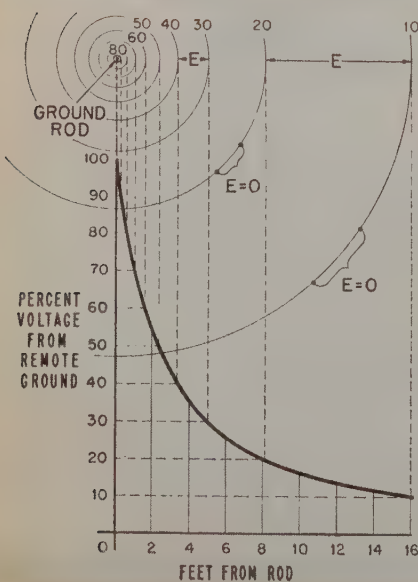
An improvised ground should preferably be located about 50 ft away, or at least as far from the structure as the guy anchors are, and apart from the work area of groundmen if possible. By keeping the ground some distance away, groundmen will be away from the high gradient area.

When structures are guyed, all guys may be conductively connected to the pole bands to avoid carrying a separate ground conductor down a pole. Multiple grounds (such as guys) spaced to encompass the work area increase the fault-current, but decrease the earth gradients.

Same Holds For Substations

Basically, there is no essential difference between grounding in stations and on lines for workmen's safety. Grounding at the work area is the surest way to eliminate voltage between equipment and the station ground. Fault currents may be higher in stations than on lines, and so parallel grounds placed on each side, but close to the work area, may lend added assurance to the adequacy of the ground.

The station mat is usually a better ground than a tower, and also, groundmen are usually within the area covered by the mat where ground gradients are not nearly as great as they can be at a tower. However, the practice of grounding all three conductors at the work area to minimize hazards applies to stations as well as to power lines.



REMEMBER!

When a line fault or lightning flashover sends current through a tower, it sets up a voltage gradient around the tower base because of current flowing through earth and footing resistance. Voltage between a tower leg and ground rod only one foot away has been measured at more than 3000 v when about 8000 amps flowed to ground in the tower.

Because of earth gradient around a tower leg with fault current flowing, the following conditions are evident:

1. The most hazardous condition occurs when a person stands close to a tower leg and touches it with his hand. (He gets the highest part of the potential gradient and the current passes through his heart—the worst possible situation.)
2. If a person stands with feet apart with his side towards the tower, he bridges equipotential lines and causes current to flow through his legs.

There Are No Guarantees Of Safety, But:

Faults usually occur without warning and may cause temporary muscular paralysis, but how a man happens to stand or step near a tower during a fault can determine the hazard to him. The least danger exists when he stands on one foot without touching anything. The next best position, with both feet on the ground is to keep the feet together and stand facing the tower (or ground rod) so the feet will be on an equipotential line.

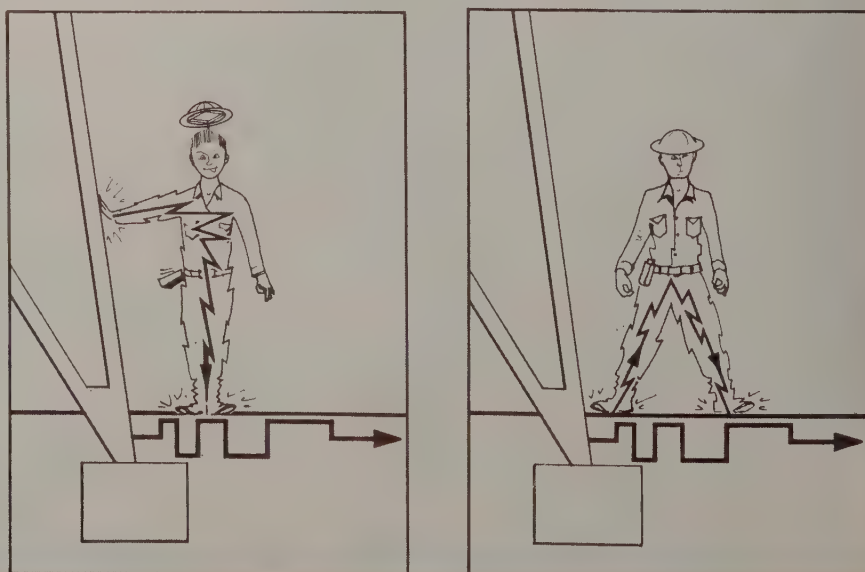
During sustained fault emergencies, a man can enter a danger area relatively safely by hopping from foot to foot, provided both feet are never on the ground at the same time. Use a dry wood stick or board for support or to move an energized conductor.

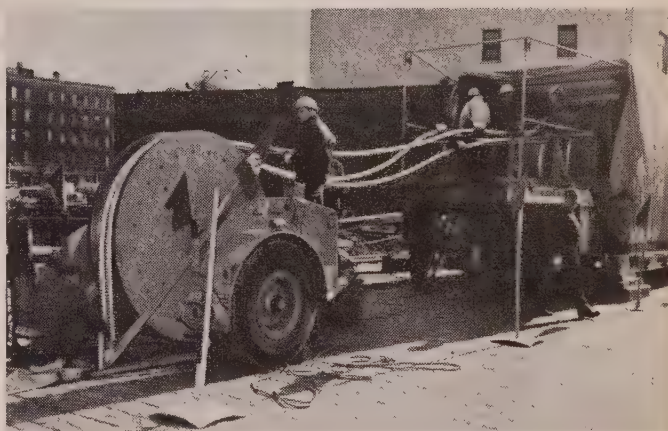
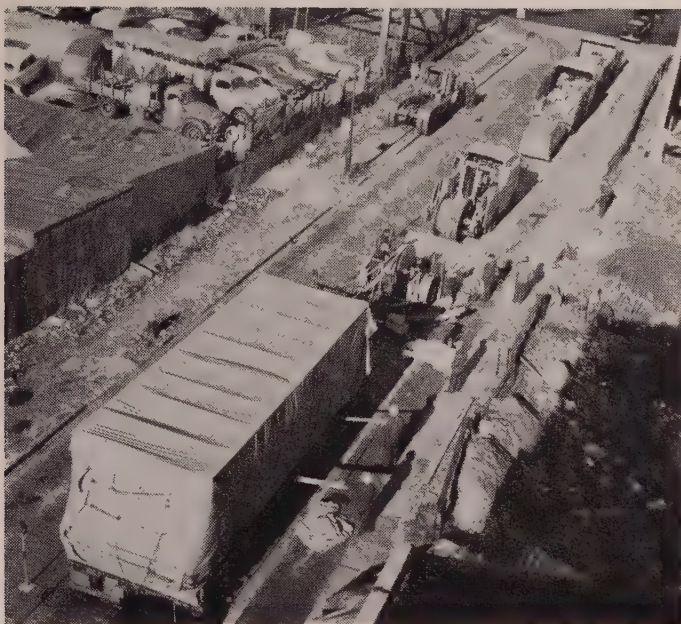
If caught near a tower during a lightning storm—or at a time a tower may carry fault current—the safest place for a man is to be on the tower near the base. Again, the worst place is with one foot on the ground and the other foot or a hand on the tower. There is much less voltage drop in tower legs than there can be in the ground nearby. If aware of an approaching emergency, a man may be able to jump from the ground to a tower so that he does not touch the tower and ground at the same time.

Here is what happens when current flows in the earth. The gradient between equipotential lines is highest near the grounding point. Tests show that the voltage drop along the surface of the ground usually decays at some exponential rate, less than the square of the distance, but more than linearly.

Most hazardous practice for a man on the ground during fault or lightning current flow in the tower.

Another hazardous practice. It is safer to keep feet together and face tower (or stand on one foot.)





138-kv cable being fed directly from trailer to manhole as part of Con Ed's improved cable-pulling operations.

Straight-line cable operation keeps traffic interference to a minimum.

CON ED'S NEW TRAILER FRAME IMPROVES CABLE-PULLING

Consolidated Edison's field construction forces have further mechanized cable-pulling operations by designing a trailer frame for transporting reels of underground transmission cable. The revamped trailer simplifies operations, since it cuts down on the use of motorized equipment, saves time, and reduces manpower requirements. Through it Con Edison hopes to lower considerably the cost of its 138- and 69-kv transmission expansion program.

The trailer frame enables three reels of cable to be transported on one trailer which is now loaded at the factory. Formerly, two trailers were needed to haul the three reels to the job site. The use of a crane during operations also has been eliminated, since no longer must the reels be set on the ground, but instead can be fed directly from trailer to manhole. These additional trailers and cranes are therefore free to be used on other jobs.

Reduce Time One-Third

The duration of the cable-pulling operation has been reduced by as much as one-third. In the past, two sections of cable-pulling could never be done in less than ten to twelve hours. Now it is done in less than eight hours.

Simplification of work and reduction in equipment have also freed skilled men who will provide the additional manpower needed to handle the company's stepped-up cable-pulling schedules for 1960-61, an acceleration necessitated by anticipated load growth.

Use of the revamped trailer and removal of crane from job site have made cable-pulling a straight-line operation. Only one lane of traffic is now blocked up, so that the city and its people can go about their business with a minimum of disturbance from Con Edison work crews.

Safety Increases

Safety advantages are also noteworthy in the improved operation. Since the reels are now set on a trailer, there is no danger of their tipping over. In the past, when reels were supported on the ground by jacks, contours in the road sometimes caused the reels to rest at an angle, and as they unwound the weight would shift on the jack, causing a possibility that the 6- to 11-ton reel might tip over. Another danger removed is from falling lag-sticks, since they have been replaced by sheets of tech-board. The bullwork of pushing jacks and empty reels has also been eliminated, therefore lessening the chance of strain.

The trailer itself is 44-ft long, 10-ft wide and 13-ft-2-in. high with a carrying capacity of 44 tons. It is covered by canvas to protect the cable from rain and snow. Tech-board, which is less costly and takes less space than the double lag-sticks formerly used, also serves as a protection from dampness.

At present two trailer frames have been placed in operation by the Outside Plant Construction Department. The Company hopes to add at least two more.

STEPLADDER IS SAFE, PORTABLE

By H. R. Stephenson, Engineer
Hiawatha Diesel Plant
The Kansas Power & Light Company
Hiawatha, Kansas

With many of today's shelving methods, a safe, portable stepladder is desirable. Such a ladder can be constructed of acetylene-welded $\frac{3}{4}$ in. thin-wall conduit. The ladder is easily portable until someone steps on it at which time it rests firmly on its rubber-tipped legs.

Welded on to the framework are step girds of $\frac{3}{4}$ in. angle iron. Steps are sheet steel and are covered with a rubber stair mat. Top step is 12 in. x 18 in. wide; the two lower steps are 8 in. x 18 in. wide. Each step lift is nine in. Casters are ball-bearing, 3 in. dia. and are made of

composition material. Ladder legs are tipped with rubber crutch tips. Overall height is 52 in.; depth is 28 in. and width is 18 in.

A series of levers with the aid of a spring, suspend the ladder on the casters until some small weight is placed on the first step. Weight on the step overcomes spring tension and sets the legs down to grip the floor firmly.

Once a person steps off the ladder, the spring again takes over, lowers the casters, and the ladder again becomes portable.

Author Stephenson prepares to push the portable thinwall conduit stepladder which he designed, across the supply room floor. As soon as weight is placed on the steps, the rollers retract and ladder rests on its own four feet.



FIBREGLAS DUCT RODS FACILITATE UNDERGROUND CONDUIT CABLE SERVICING

Interlocking sections of fibreglas duct rods are helping Consolidated Edison install hundreds of miles of underground cable. Used in sections up to 10 ft, the rods are connected in ducts from one manhole to another to snake pulling wires through the empty ducts. They are non-conducting and their flexibility

allows them to make turns and angles without difficulty.

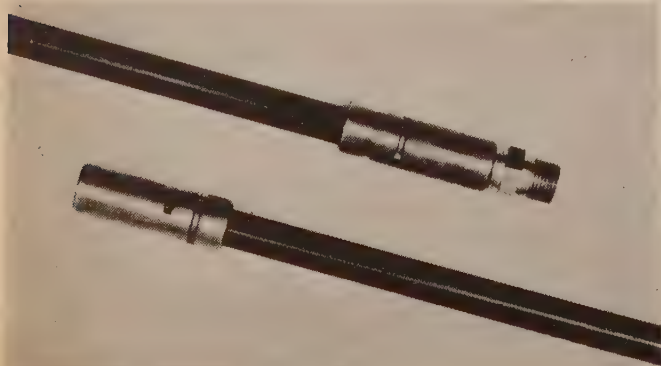
A double male nipple provides a positive and quick coupling and uncoupling connection. It is made of Parker FF-F $\frac{3}{8}$ -in. steel with a $\frac{3}{4}$ -in. hex and connects to the rod by female ferrules made of $\frac{1}{4}$ -in. standard brass pipe. The ferrules are double-crimped to withstand

3,000 lbs tension. The rod proper is made of re-enforced fibreglas strands and has approximately a $\frac{5}{8}$ -in. diameter.

Designed by Con Ed Engineers, the rods are available from stock from Fredricks Co., 154 North Franklin, Hempstead, New York. Desired lengths to customer's specifications are also available.

Con Ed workmen feed interlocked sections of the fibreglas duct rods into a manhole. These rods, used to snake pulling wires through empty conduit are non-conducting and are flexible enough to make any turns or angles in the conduit.

The double-male nipple, made of Parker FF-S $\frac{3}{8}$ in. steel with $\frac{3}{4}$ in. hex, provides quick and positive connection to the female ferrules. Ferrules are made of $\frac{1}{4}$ in. standard brass pipe and are double-crimped to withstand more than 3,000 lbs.





BAY FRONT STEAM GENERATING PLANT LAKE SUPERIOR DISTRICT POWER COMPANY 80,000 kw — 6 Units

Power on Lake Superior...

Lake Superior District Power Company is following a program of continual expansion in Northern Wisconsin and Upper Michigan to keep pace with the area's rapid recreational and industrial development. A modernization project recently completed at the Bay Front Steam Generating Plant resulted in the installation of 65,000 kw of modern generating capacity. This expansion program follows closely an aggressive promotion of electric power. This policy has been influential in increasing the residential use of electricity to more than 25% above the nation's average.



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Management Change Toward Instrumentation Noted

Management "climate" toward instrumentation and automation has changed radically over the past 8 years according to George M. Muschamp, Vice President-Engineering, Industrial Products Group, Minneapolis-Honeywell Regulator Co. Speaking before a recent meeting of the New York Section, Instrument Society of America, Mr. Muschamp said, "Where before the sole initiative seemed to be in the hands of instrument specialists, working against an almost apathetic management, today management is taking a more attentive, if not aggressive, position with respect to automatic control." Referring again to the changing management climate he stated that, "the scope of automatic control problems is constantly widening and thus taking the decisions higher and higher and, therefore, closer and closer, to top management. Furthermore, the cost of solving these problems and the effect this has upon existing organization is requiring more and more attention of top management."

While machines can and are being made to do most of the routine functions that man can do, the fact is that we are currently asking computers to do things which people are not now doing. This, according to Mr. Muschamp, is one of the most important facts about computer-directed systems today.

He pointed out that as a result of studies leading up to the installation of a computer system, computers are being asked to do jobs which *might* have been done by people if management had been aware of the problems before the studies were made. The point he emphasizes here is that the things have not been and are not now being done by men and this has no bearing on

(Continued on facing page)

Simulated Sunshine To Warm Racing Fans

A unique installation of tubular quartz infra-red heat lamps will provide simulated sunshine to keep racing fans comfortable when they attend the early Spring and late Fall trotting races at Maywood Park Race Track in Chicago. In addition to providing warmth for the nearly 4600 racing fans who can be seated in the 21,000 square-foot grandstand, the lamps will also produce a high level of lighting.

Using 270 pencil-thin 3800-watt G.E. lamps in reflector fixtures especially designed for the installation by Luminator, Inc., of Chicago, the system provides up to 30 watts of radiant energy per square-foot of seating level. This is equivalent to more than 100 BTU's per square-foot or about three times as many as are required in the average home. Additionally, the system will produce lighting of 70 to 80 foot-candles or levels equal to those recommended by lighting authorities.

The lamps are housed in six rows of reflectors so spaced as to give an even distribution of heat and light. The front three rows are mounted at various heights up to 33 feet and consist of 4-lamp units.

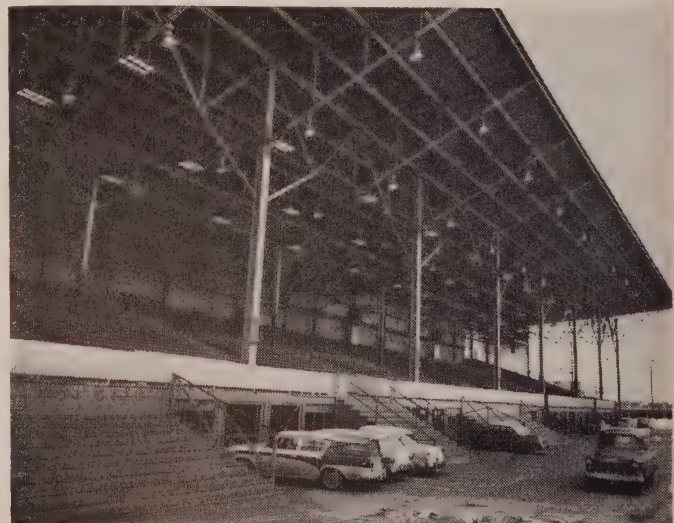
View of Chicago's Maywood Park Race Track, which has been made the nations best-heated and lighted by the installation of a 1000-kw infrared system. Six rows of fixtures housing 270 3800-watt General Electric quartz infra-red lamps produce 30-watts of radiant heat at seating level, and a lighting level of about 80 footcandles. The grandstand has a seating capacity of 4600.

The back rows of 2-lamp reflectors have a minimum mounting height of 14 feet. To prevent excessive "spill" of radiant heat out of the grandstands, special symmetrical reflectors are used in the front row.

The heating system will be operated by a push-button control panel in the track tower. The operator can turn on the lamps in any or all of four sections, depending on occupancy of the stands. To adjust for temperature conditions he can operate the lamps at full- or half-intensity.

A new 1500-kva sub-station built by the Public Service Division of Commonwealth Edison Company supplies power for the heating system and other electrical needs of the track.

Officials of the Maywood Park Trotting Association, which operates the track, expect the heating-lighting installation to attract larger crowds for races and to make it attractive for them to remain later in the evening during chilly weather. This is especially necessary as the track racing season this year extends from March 18 to June 1 and from September 6 to November 30.



MUSCHAMP . . . continued

whether or not men can do them.

These, then, are new things. Things which bear very importantly on the economics of operation. Because they are economic, they involve upper management more and more and are things which management understands somewhat better than the detailed variables of individual measuring and control loops.

Naturally, with top management becoming more automation and instrumentation conscious, suppliers are being called upon to produce a variety of different types of equipment. To meet this challenge properly, the suppliers must face a spectrum of apparatus in system situations bearing from the simplest thermacouple all the way up to and including the most sophisticated digital computers and the integral systems involved. Even more basic to the problem, is the provision of suitable system engineering so as to insure the proper integration of this complex mass of equipment in economically and technically sound systems.

Summarizing his talk, Mr. Muschamp said, "What I have been saying implies direct challenge to the level of management administering processed design system engineering and instrumentation. A challenge to assume an important role next to top management. A role in which the scope of influence is company-wide.

"For the same reasons, the challenge to top management becomes enormous in terms of the risks to be taken—risks of the large cost of these systems if the challenge is met—risks of the loss of competitive position if the challenge is not met.

"As I have already suggested, top management of many companies seems to me to be prepared to meet this challenge and I think they are ready to welcome sound advice and guidance from their systems management. The continuing rise in labor costs, the sharp competition in price and quality both at home and abroad, the expansion into new fields with limited technical and production manpower are factors which really leave top management with little choice but to push automation to the utmost.



AGAIN . . . Coffing Brings You a New Line of Hoists

The new Safety Pull Aluminum Ratchet and Pawl Lever Hoist is easy to operate—requires minimum handle pull. It may be operated from either side, and the design prevents freezing a load.

Safety has been built into the hoist. It will not ratchet under load if handle is released nor will it free chain. Controls are protected from inadvertent shifting. The bottom stop eliminates any hazard from the handle being released unintentionally. The exclusive safety handle bends to indicate overload.

Strength without excess weight in the new hoist is achieved by a special aluminum alloy which is used in the body and handle.

Available in six models with capacities from $\frac{3}{4}$ to 6 tons. Ask your distributor or write for Bulletin ADH-86.



COFFING HOISTS

DUFF-NORTON COMPANY

807 Walter Street

Danville, Illinois



THESE QUALITY PRODUCTS
CAN CUT YOUR OPER-
ATING COSTS AND WE
CAN PROVE IT!

ALBANY IMPROVED CABLE PULLING COMPOUND

. . . makes LEAD-COVERED cable
pulling smoother and easier.

- Unaffected by summer heat or zero temperatures.
- Sticks to sheath even in water-filled ducts.
- Actual dynamometer tests show greatly reduced pulling stresses.
- Clean to work with.

ALBANY RBR WIRE PULLING COMPOUND

. . . makes COVERED WIRE
pulling easier and faster!

- Excellent for non-metallic cable . . . non-evaporating.
- Will not affect coatings.
- Needs no mixing . . . will not separate or harden.
- Light, clean to use, easily washed off with water.



WANT PROOF? WRITE FOR FREE WORKING SAMPLES

ADAM COOK'S SONS, INC.

Electrical Products Division

5 N. STILES STREET

LINDEN, N. J.

PUSH BUTTON PEAKING



What's the difference in submarine cable?

With **USS** Tiger Brand, it's proved reliability

Forty years is a long time for a submarine cable to be in continuous operation, but many of the original Tiger Brand Amarine Non-leadless Cables have been in reliable service that long. These rubber-insulated cables have won high regard from electrical engineers for both power transmission and communication service.

Amarine cables are highly engineered. Each one is designed for a specific application. Quality is built in from start to finish with special attention to moisture-resistant rubber compounds. These retain their electrical characteristics after years of under-water operation.

Testing specifications are stringent. They go far beyond those ordinarily used because once a submarine cable is laid, it's too costly to lift for frequent repairs.

To make sure that every Tiger Brand Submarine Cable is installed properly, one of our

experienced field-service engineers is assigned to the project to help supervise installation.

Amarine Leadless Cables save money because they are lighter, smaller and more flexible. They are easier to handle, cost less to install.

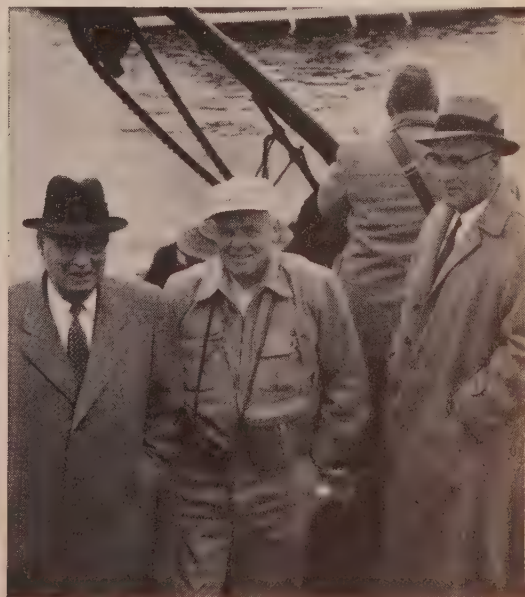
For more information about submarine cable or any other kind of USS Tiger Brand Electrical Wire and Cable, write American Steel & Wire Division, Dept. 0191, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

USS, Amarine and Tiger Brand are registered trademarks



**American Steel & Wire
Division of
United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad





INDUCTIVE PICK-UP IN INSULATOR'S CLOTHING

This is a current-sensitive pick-up* whose looks may be deceiving: the "package" is a post-type insulator, but buried in it is an inductive pick-up coil. For every 60 amps flowing in the conductor, one volt is induced in the coil—and the relationship is *linear*, within a few percent, up to 5000 amperes. Furthermore, the voltage bears a fixed phase relationship to the conductor current.

We could offer this as a "standard product" (in fact, you can order one or a hundred right now, if you like), but it seems better to tell you how it works and then hope you'll tell us what you want to do with it. You can use it to feed a vacuum tube or transistor controlling circuit, one or more relays, a magnetic amplifier, panel instrument and other "black boxes". Here a few

possibilities — some of them ideas, others actual applications: capacitor switching on the basis of phase angle or current; load limit tripping, checking or warning; built-in means of measuring line current; power direction sensing. No matter how you use it, this pick-up offers several possible advantages to you: low first cost and installation economies, safety, convenience, elimination of hot sticks and dead-ending

Some of these devices have been installed in the field along with the appropriate black boxes. We even have a few of these boxes all made up, and can build more. If you have an idea about how you'd like to use this pick-up, we'd certainly like to hear from you. The Fisher-Pierce Co., 81 Pearl St., So. Braintree 85, Mass.

*Pat. Pending


FISHER PIERCE
PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

Faster, More Sensitive Control System Announced

An electro-hydraulic control system said to be ten times faster and four times more sensitive than present mechanical controls has been announced for General Electric's medium capacity steam turbine-generators.

The new system is viewed by the Company's Medium Steam Turbine, Generator and Gear Department as a giant step toward power systems automation.

Because the system eliminates many parts, installation is easier, operating costs are reduced and maintenance is facilitated. Faster and more sensitive frequency and process pressure control is attained.

The new control system consists of a tachometer generator, pressure transducer and a solid state analog computer which directs hydraulic valve positioning devices.

First application of the new form of controls will be on units for industrial manufacturing facilities requiring power generation and process steam.

HELP WANTED

POWER ACCOUNTANT—Middle East location. Maintain accounting comparable FPC system for generation, transmission, and books for distribution including operating, customer, and capital records. Supervise, train local personnel. 10 years accounting with substantial electric utility experience. Salary \$16,000 to \$18,000 with two-year contract and other benefits. Address Box 4154, **ELECTRIC LIGHT & POWER**, 6 No. Michigan Ave., Chicago 2, Illinois.

HELP WANTED

GRADUATE ELECTRICAL ENGINEER — Electric Utility in Eastern Massachusetts. Some experience in transmission and distribution desired. Please answer, giving education, experience and salary expected. Write Box 4153, **ELECTRIC LIGHT & POWER**, 6 No. Michigan Ave., Chicago 2, Ill.

DON'T READ THIS AD

if you don't want to get ahead.
TRANSFORMER ENGINEERS WANTED—Sales or Service, Mechanical Design, Electrical Design, Production or Industrial. Excellent prospects for top men with rapidly expanding company. Write or call **PRECISION TRANSFORMER CORPORATION**, 2218 West Lake Street, Chicago 12, Illinois. Telephone SEeley 8-2906.

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Transmission Engineers not only must know the requirements for their lines ... they must also see that they are met. And, they have found that Fanner Superformed products are always reliable.

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ARMOR RODS...

Protect long-span T&D lines at supports

LINEGUARDS...

Protect short-span T&D lines at supports

PATCH RODS...

Repair damaged conductors

TAP ARMOR...

Protects conductor at tapping points

FANNGRIPS...

For dead-ending strands and conductors

FANNSPLICES...

Join two ends of conductor wire

PLASTIC PRODUCTS...

For conductor surface protection

FANNER

The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

Painting Transformers . . .

(Continued from page 85)

All connections, including grounds, are inspected, cleaned, and renewed, if necessary. A note is made of any condition found that the crew cannot correct. All rust, dead paint, and oil is removed from the tank. In addition to scrapers, wire brushes, emery cloth and power drills, a solvent is used to loosen oil and grime.

The bushings are covered with masking tape. The tank is washed with a phosphoric acid solution ($\frac{1}{2}$ lb to 1 gal of water) and wiped dry. This is to neutralize the salt. The brown primer is applied, using a brush. Spraying would result in too many spotted automobiles and houses. Mounting hardware is cleaned and coated with a zinc-rich compound. The transformer is energized and left to dry overnight.

Finish Coat

The next day the finish coat is applied. The face of the tank, where the rating is to be stencilled, is painted first. By the time the coat is completed, the first paint applied is dry enough to stencil over. This avoids an additional visit for stenciling. The masking tape is removed from the bushings before energizing. This completes the job.

The work is being done on a "cost plus" basis. The contractor furnishes labor, equipment and tools. The Company furnishes paint, thinner, acid and cleaning solvent. Over 1100 transformers have been inspected and painted for less than 60% of the estimated cost of taking them to the shop for painting. In fact, the cost of merely taking a transformer down and hanging another (25kva) is almost 30% more than the complete in-place job.

A stock of specially painted transformers is kept in the warehouse yards at Wilmington and Morehead City. The line crews carry enough paint for touching up after hanging. The fact that one of these transformers occasionally finds its way to an inland area does no material harm.

Once the entire territory has been covered, a few days of touching-up every year should prolong the life of the tanks almost indefinitely.



No. 1959-AR

No. 1958-AR

NEW KLEIN Replaceable Gaff Adjustable Climbers

These new Klein Replaceable Gaff Climbers assure maximum quality and safety. We recommend leg irons be replaced after three sets of gaffs have been used.

The easily replaceable gaff is held in position by a self-locking screw. Full impact is absorbed by the gaff and leg iron. No load is transmitted to the screw.

Adjustable to 14½, 15, 15½, 16, 16½, 17, 17½, 18, 18½ and 19 inches. Made in matched pairs, right and left. Available with triangular ring at ankle or riveted ankle loop. Aluminum finish. Every climber individually tested.

WRITE FOR BULLETIN 559

Bulletin 559, giving full information on Klein Replaceable Gaff Adjustable Climbers, will be sent on request.

ASK YOUR SUPPLIER

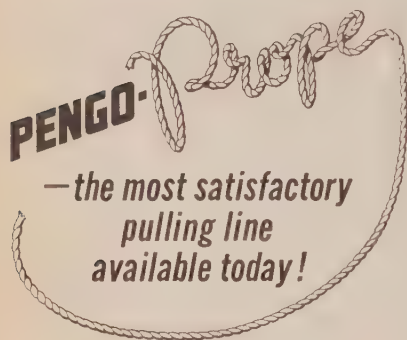
Foreign Distributor: International Standard Electric Corp., New York.

Máthias KLEIN & Sons
Established 1857
7200 MCCORMICK ROAD • CHICAGO 45, ILLINOIS





ANNOUNCING



—the most satisfactory
pulling line
available today!

*** GREAT STRENGTH**

(9,600 lbs. tensile for $\frac{3}{4}$ " diam.)

*** LIGHT WEIGHT**

(11.7 lbs. per 100 ft., $\frac{3}{4}$ " diam.)

*** HANDLES AND
SPICES LIKE MANILA**

in any climate or weather.

*** WATERPROOF,**

(even salt water) can't mildew;
excellent dielectric properties.

PENGCO-Prope is a synthetic rope of special construction for pulling line use; no other rope can match its safety and cost-saving performance! Write today for literature, prices.

PENGCO-Miller

LINE
STRINGING
SWIVELS



Special models of the well-known MILLER swivels redesigned specifically for tension line stringing use.

The result is a reliable, heavy duty swivel of proper dimensions to pass through stringing sheaves and bullwheel grooves easily, without damage.



PETERSEN

ENGINEERING CO., INC.

Santa Clara, California

Phone: AXminster 6-7712

B-10

NEW PRODUCT

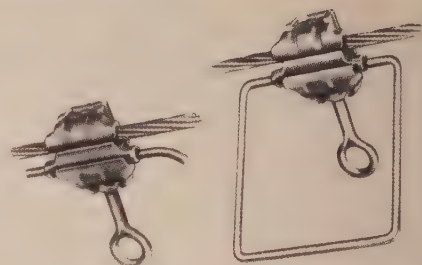
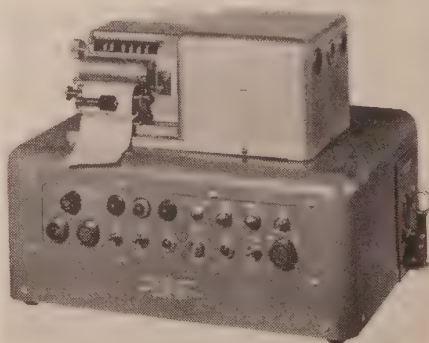
DESIGN



Readout Device

Series B, P, and V "Digiprinter" by Moran Instrument Co. is a self-balancing potentiometer which, when used in conjunction with standard transducers such as strain gauges, load cells, etc., provides a visual readout of information as well as a printed readout similar to that of an adding machine.

Circle item #20 on reply card



Hot Line Clamps, Stirrups

BC Series hot line clamps and stirrups are available from Fargo Mfg. Co., Inc. Based on "vise type" design with extra long, contoured jaws, the BC Series offers extra contact, rapid heat dissipation, better interstrand connection, and improved conductor encirclement. The soft pure aluminum spacer assures a short, high conductivity current path between conductors.

Circle item #22 on reply card

Insulated Aerial Beam

An aerial beam, insulated from ground to withstand in excess of 50 kv, has been added to the Sky-Master line of aerial equipment of McCabe-Powers Body Co. Movement of the independently-controlled beams and rotating mast is hydraulically powered. Outer beam can be positioned at any point in a 270-degree arc, inner beam can be moved to any point in a 110-degree arc, and mast can be turned continuously in any direction.

Circle item #21 on reply card



Steam Cleaner

Speedyelectric Hydro Steam-Jet Cleaner by Pan-Tex Mfg. Corp. provides three-fold cleaning. Unit operates with a single hose and heavy duty swivel steam gun and can be used as an effective high pressure steam cleaner, with or without detergent, or quickly switched to a high pressure hot or cold rinse unit or a dry steam cleaner where excessive water is objectionable. Fully electric.

Circle item #23 on reply card

(Continued on page 108)



ORDINARY SEMI-CON TAPE

"Meggers"—courtesy James G. Biddle Co., Philadelphia, Pa.

JOINTS AND TERMINATIONS ON HIGH-VOLTAGE CABLE

removed semi-conducting particles. The meter readings will show that a moment of buffing is all that's needed to complete surface preparation for the build-ups and the most reliable splice or termination possible today.

The planned research and production program which brings you this outstanding cable development is also responsible for the equally important developments in Butyl rubber insulation compounding, and extruding, which have produced the best possible balanced design and construction of high-voltage rubber-insulated cable obtainable today—Anaconda Durasheath.

For more details, write for Anaconda Bulletin DM-5903, covering Durasheath High-Voltage Cable and DMS-5566, 5720 & 5735 dealing with the splicing & terminating of Durasheath Cable. Contact your nearest Anaconda Wire & Cable Company District Office, or write to: 25 Broadway, New York 4, N. Y.

60238

ASK THE MAN FROM
ANACONDA[®]

ABOUT DURASHEATH[®] CABLE

Bundled Conductor Blocks

A simplified block designed for stringing bundled conductor simultaneously has been developed by **Campbell Specialty Co.** It is designed with two 18 in. sheaves on fixed centers and a center drum roller for the winch line. As the conductors are advanced, the spreader bar passes over sheaves and drum. Sheaves are of aluminum alloy and are available with Neoprene liners. The top of the steel frame opens for easy removal from conductors, but locks securely when closed.

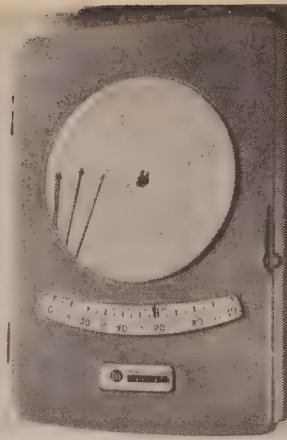
Circle item #24 on reply card



Recorder-Receiver

Several more sensitive and versatile **Chronoflo®** Recorder-Receiver arrangements by **B-I-F Industries** feature a newly-engineered power positioner with faster and quieter response. Units also have 2-, 4-, 8-, 15-, and 60-second time-cycles, up to 16 control switches for alarm and control functions. Employs swing-out panel for easy access, modular construction, and multiple pen arrangements. For telemetering flow, pressure, temperature, level, RPM and position.

Circle item #25 on reply card



Adjustable Meter Stand

Model HCM Stand by **Hykon Mfg. Co.** is designed for use in a cable or wire measuring system which can be adjusted for various reel sizes. May be set from 30 in. to 48 in. in height and permits the meter to turn freely in the stand. Requires only tightening of a single thumb screw to adjust for height. Stand has rigid all-steel base for firm support. Normally portable, it may also be lag bolted to the floor. A bench stand for permanent mounting is also available.

Circle item #26 on reply card



G-E "COMPACT ISOKRAFT" 50" CAPACITORS OFFER

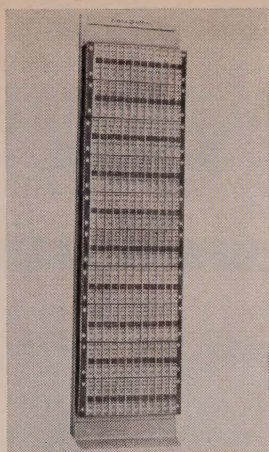
900 KVARS AT



General Electric's new "COMPACT ISOKRAFT 50" capacitor represents the lightest and most compact 50-kvar unit available. And because of these benefits, higher rated, lighter capacitor equipments can be installed in locations where weight and size are limiting factors.

Single-row capacitor equipments offer the cumulative weight reduction of these new, 4-inch-thick, 82-pound, 50-kvar units. They weigh less and, installed, have less extension beyond the pole. Easier, less expensive installation and improved appearance on the pole result.

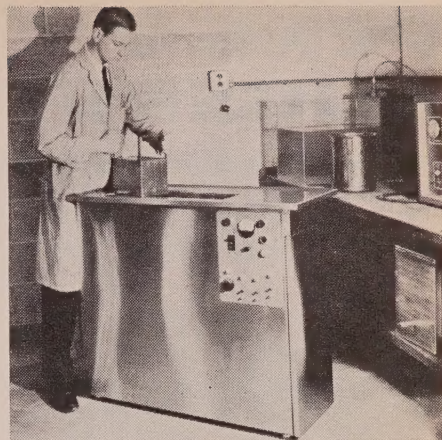
"COMPACT ISOKRAFT 50" capacitors help make available a 900-kvar single-row equipment that weighs less than the first 600-kvar equipment introduced in 1956. And the 900 kvars fit into an



Multipoint Recorder

The **Honeywell Universal Model 15 ElectroniK Recorder** is designed for application in laboratories and processes where frequent record changing is required. Applications include spot-checking of boiler tube, gearing and transformer oil temperatures, nuclear reactor coolants and in connection with nuclear radiation detection systems. Number of points recorded can be changed by operator.

Circle item #28 on reply card



Ultrasonic Degreaser

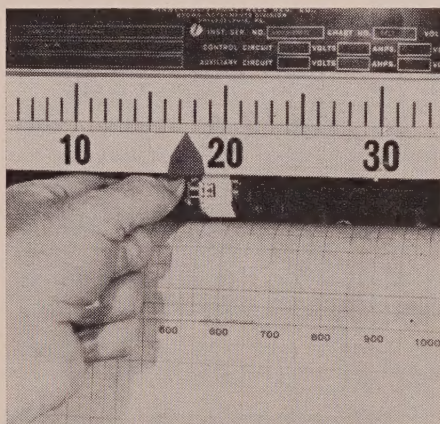
Model AC-25 Sonogen® by **Branston Ultrasonic Corp.** is a self-contained ultrasonic degreaser which quickly and thoroughly removes metal chips, grease, and certain insoluble soils even from intricate parts. Process includes immersion in degreasing tank, spray-rinse by hand, exposure to vapor, and removal. Does not require separate generator, cleaning tank or rinsing tank. Only water and 110-v, 60-cycle connection are necessary.

Circle item #29 on reply card

Multiplex-Carrier System

A transistorized multiplex-carrier system capable of handling up to 600 voice frequency channels on a single radio beam has been introduced by **General Electric**. The G-E single sideband suppressed carrier system has toll quality of meeting international and domestic long distance standards. There is a substantial reduction in power drain, plus a one-third reduction in space.

Circle item #27 on reply card



600-KVAR WEIGHT

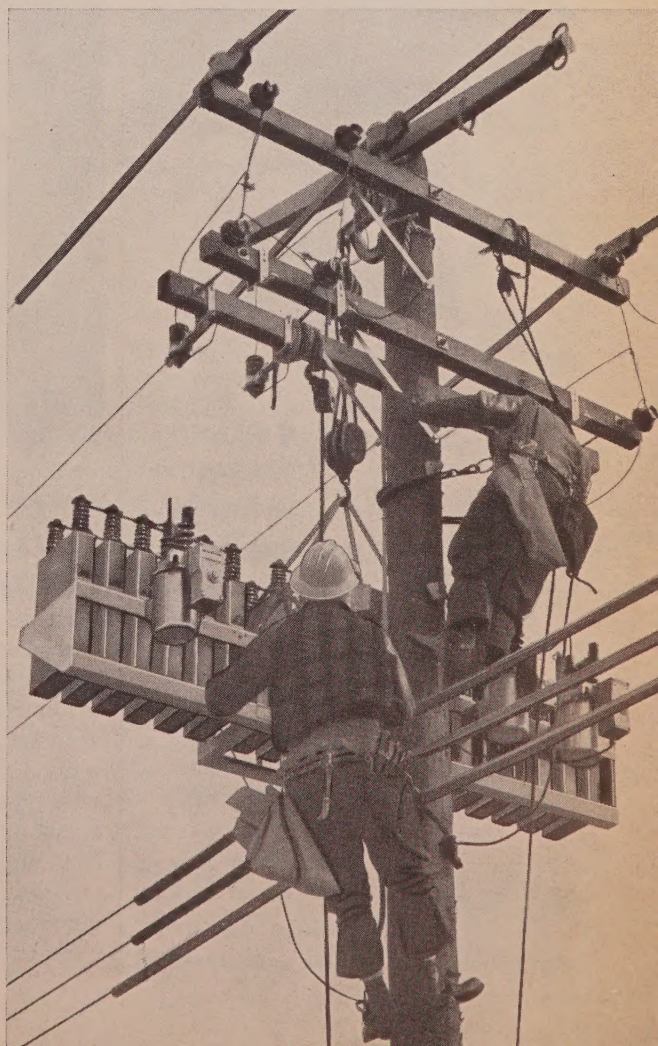
equipment that extends only 5 inches more beyond the pole than a 600-kvar equipment with superseded 50-kvar units.

And further reducing costs, self-protecting aluminum racks and corrosion-resistant stainless-steel capacitor cases eliminate the need for periodic protective paint maintenance.

For more complete information contact your **General Electric Apparatus Sales Representative**, or write for Bulletin GEA-7061, General Electric Co., Section 445-32, Schenectady 5, N. Y.

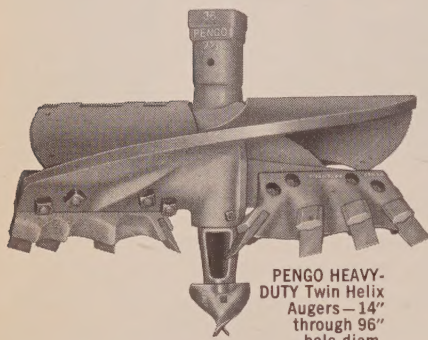
Progress Is Our Most Important Product

GENERAL ELECTRIC



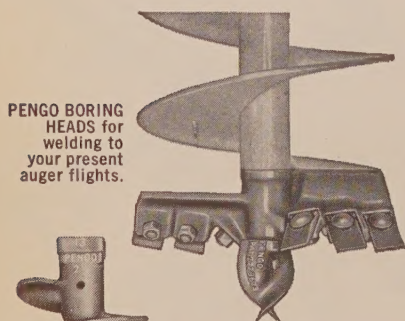
PENGO AUGERS

Save you money
4 ways

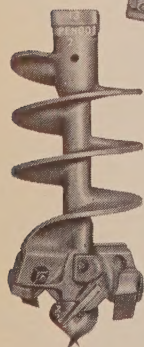


PENGO HEAVY-DUTY Twin Helix Augers—14" through 96" hole diam.

- 1 **BORE FASTER**...put real "teeth" in earth drilling, save wear and tear on your diggers.
- 2 **STAY ON THE JOB LONGER**...all wearing parts replaceable in the field; no down-time for shop welding.
- 3 **COST FAR LESS TO MAINTAIN**...reversible teeth cost only 90¢ each, pilot bit only \$8.00. Parts interchangeable on all PENGO augers you are using...less inventory!
- 4 **A SIZE AND TYPE FOR EVERY DRILLING JOB**



PENGO BORING HEADS for welding to your present auger flights.



PENGO FLIGHT AUGERS and ANCHOR AUGERS—6" through 36" diam.

IF IT'S AUGERS
YOU WANT,
WE HAVE 'EM—
JUST ASK US!

PENGO Augers and Boring Heads are available for all popular types of diggers, from light-duty post hole and farm tractor machines to the largest heavy-duty earth drills. Write today for free catalog; please address Dept. 28.

13-B



PETERSEN
ENGINEERING CO., INC.
Santa Clara, California

MEN OF



POWER

Heller Duquesne Light VP

R. W. Heller has been elected a vice president of the Duquesne Light Co. He succeeds G. W. Ousler who retired March 1.

In his new capacity, Mr. Heller will be responsible for the activities of the sales division.

Mr. Heller has been with the company since 1924, when he became a power sales engineer. He has since served as supervisor of Industrial Sales and Director of Industrial Sales. He was named manager of residential sales in 1950.

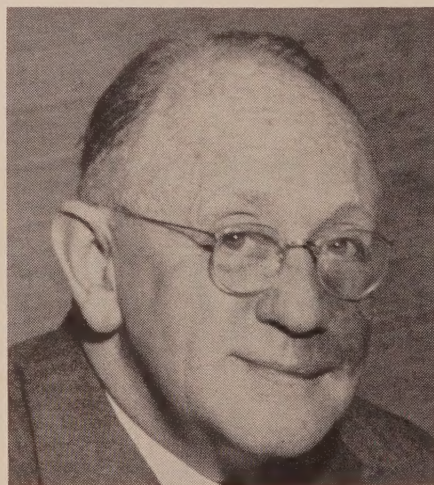


Ousler To Wiegand

George W. Ousler, retiring vice president of sales, Duquesne Light Co., has been appointed an executive with Edwin L. Wiegand Co., manufacturer of electrical heating equipment.

Mr. Ousler will become assistant to the president, with the principal assignment of coordinating the company's electric heating program with those of utilities across the country.

Mr. Ousler has been active in utility affairs for many years.



United Engineers Elect 2

Election of Robert R. Wagstaff and John T. Pinkston to posts as vice presidents of United Engineers & Constructors, Inc., has been announced. Mr. Wagstaff has been with United Engineers since 1937 when he joined the firm as an electrical engineer. In his new position Mr. Wagstaff will be in charge of engineering. He will also be a director of the company.

Since joining the company he has

held posts of assistant electrical engineer, electrical engineer, supervising engineer, and most recently, chief engineer.

Mr. Pinkston will retain his responsibility as process consultant, the post to which he was appointed when he joined United Engineers in 1959, and will be in charge of all process development activity.

Prior to joining United Engineers, Mr. Pinkston was manager of process at Catalytic Construction Company.

Low-cost ground-line protection

WITH CHAPMAN POL-NU

Now treat standing poles easily with the Pol-Nu Bandage-Maker

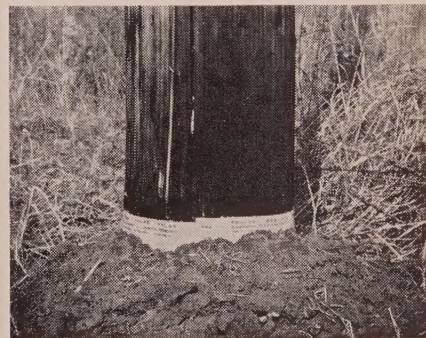
Chapman Pol-Nu is the superior Pentachlorophenol preservative developed for ground-line treatment of standing poles. Applied in a pole bandage, it restores preservative protection to this critical area of the pole to extend life for many years. The Pol-Nu Bandage-Maker shown in use here speeds treatment, insures its effectiveness and reduces costs below that of any other method.



1. Bandage-Maker produces pole bandages of exact size required as they are needed. Pol-Nu feeds onto plastic-coated paper in a uniform, measured amount without waste.



2. Bandage is wrapped around previously cleaned and inspected pole. It is not necessary to wait for pole to dry before applying bandage. Plastic-coated paper prevents loss of preservative into soil.



3. Complete treatment with excavation back-filled assures longer pole life. Pol-Nu penetrates wood to give many years of positive protection from decay and insect attack in critical ground-line area.

With this easy treatment method, expense of applying a Pol-Nu ground-line treatment is but a fraction of the value of the additional pole life attained. For those who prefer a factory-sealed, ready-to-use pole bandage Chapman offers the Pol-Nu Pak which may be applied instantly by maintenance crews wherever needed. Mail coupon for complete information on establishing a money-saving ground-line treatment program with your own crews or independent contractor-applicators.

CHAPMAN CHEMICAL COMPANY

Leading manufacturer of wood preservatives • Memphis 1, Tenn.
Palo Alto, Cal. • Portland, Ore. • Minneapolis • Charlotte, N. C.



Mail coupon for complete data

Chapman Chemical Company
P. O. Box 138, Memphis 1, Tenn.

Please send your folder,
"Preventive Maintenance For Poles", to:

Name _____

Company _____

Address _____

Dr. Chauncey Starr, Vice President of North American Aviation, Inc., and General Manager of the Company's Atomics International Division, has been designated president of Atomics International. He remains a vice president of the corporation.

Named divisional vice presidents at Atomics International are **W. L. Sequeira**, Vice President - Administration. **Dr. A. B. Martin**, Vice President-Sales. **Dr. Sidney Siegel**, Vice President-Technical, and **J. J. Flaherty**, Vice President - Planning.

Larry J. Aubrecht has been appointed director of Management Consulting Service on the western regional staff of Ebasco Services, Inc. He will direct the resident staff of Management Consultants headquartered in Ebasco's western regional office in San Francisco.

John F. Sturzenberger has been elected clerk and treasurer of Green Mountain Power Corp. He succeeds the late **Daniel R. Casey** who died January 8. **George A. Carlson** was named to succeed Mr. Sturzenberger.

The Bechtel Corporation has elected **Rudolph D. Grammater** vice president and treasurer to membership on the board of directors.

Recently appointed controller of Wisconsin Power & Light Co. was **James R. Underkoffler**. He was previously assistant treasurer of the company.

The appointment of **Gavin Embry** as industrial engineering manager of the Pacific Coast Engineering Company has been recently announced. Mr. Embry has been with Paceco since 1957.

Robert R. Ramey has joined the Management Consultant Division of the Ebasco Services, Inc., as director of industrial relations services. Before joining Ebasco Mr. Ramey headed his own management consulting organization. Previously he was a senior staff member of Industrial Relations Counsellors, Inc.

Anaconda Wire & Cable Co. has announced the appointment of **Austin W. Dunham** as manager of utilities sales, with headquarters in New York.

W. J. Clark has been named sales manager for Jasper Blackburn Corp.

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April 20-22—Missouri Valley Electric Association, Engineering Conference, President Hotel, Kansas City, Mo.

April 21-22—Indiana Utility Association, 20th Annual Young Men's Utility Conference, Van Orman Hotel, Ft. Wayne, Ind.

April 27-29—Northwest Electric Light and Power Association, Engineering Conference, Hotel Florence, Missoula, Mont.

April 28-29—Pennsylvania Electric Association, Systems Operation Committee, Bedford Springs Hotel, Bedford, Pa.

May 2-4—Edison Electric Institute, Purchasing and Stores Committee, Annual Meeting, The Warwick, Philadelphia, Pa.

May 12-13—Public Utilities Advertising Association, Annual Convention, Waldorf Astoria Hotel, New York, N. Y.

May 12-13—Pennsylvania Electric Association, Industrial Sales Conference, Skytop Club, Skytop, Pa.

May 15-17—Wisconsin Utilities Association, Accounting Conference, Lake Lawn Lodge, Delevan, Wisc.

May 16-18—Pacific Coast Electrical Association, Annual Convention, Stardust Hotel, Las Vegas, Nev.

May 23-25—Northwest Electric Light and Power Association, Business Development Conference, Chinook Hotel, Yakima, Wash.

June 2-3—Southeastern Electric Exchange, Industrial Power Sales Conference, Battery Park Hotel, Asheville, N. C.

June 6-8—Edison Electric Institute, Annual Convention, Atlantic City, N. J.

June 19-24—American Institute of Electrical Engineers, Summer General Meeting, Chalfont-Madden Hall, Atlantic City, N. J.

September 7-9—Northwest Electric Light and Power Association, Annual Convention, Glacier Park Lodge, Glacier National Park, Mont.

September 28-30—Indiana Electric Association, 51st Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.

October 5-7—Wisconsin Utilities Association, Electric and Gas Sales and Operating Sections Convention, Schroeder Hotel, Milwaukee, Wisc.

October 9-14—American Institute of Electrical Engineers, Fall General Meeting, Morrison Hotel, Chicago, Ill.

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